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DISEASES OF CHILDREN

A MANUAL FOR STUDENTS AND PRACTITIONERS

BY

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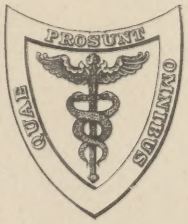
THIRD EDITION, THOROUGHLY REVISED AND ENLARGED

ILLUSTRATED WITH 47 ENGRAVINGS AND 3 PLATES



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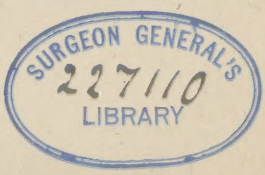

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PREFACE TO THE THIRD EDITION.

The senior author, in the first edition of this work, planned a well-balanced text-book, and determined that it should reflect with honest accuracy all of the essential phases of pediatric knowledge then current. With each subsequent edition he has endeavored to perfect that idea, and it is his hope that the book in its present form will be found more reliable and useful than ever before. While his primary purpose has been studiously maintained, almost every topic has been completely rewritten and somewhat extended to accommodate recent advances. For this task the original author has been so fortunate as to secure the assistance of his associate, Dr. Phelps G. Hurford, upon whom the greater part of the burden of the revision has fallen.

All of the important literature relating to the subject that has appeared during the past ten years has been carefully reviewed, and the deductions therefrom, checked and rechecked by personal experience, have been amalgamated with the earlier text in the construction of the new chapters.

The authors hope that the volume in its new form will be found to merit all of its past popularity, and that it may win many new friends, among both students and practitioners.

G. M. T.

St. Louis, Missouri. P. G. H.

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DISEASES OF CHILDREN

CHAPTER I.

THE INFANT AT BIRTH.

Respiration.—How Established.—In beginning extra-uterine life, breathing is a child's first new function. Previously its lungs have been impervious to air and to other than nutritive blood. Now the placental circulation is stopped and the blood must pass into the lungs to be oxygenated. By the reflex stimuli of comparatively cold air on the skin and of venous blood feeding the respiratory centre in the medulla, respiration is begun, usually with a cry. Each breath is deeper than the preceding one, until the whole lung gradually passes from a state of physiological atelectasis to complete expansion.

External Signs.—This change is beautifully demonstrated by observing the chest wall, which, being very elastic and yielding, will stay depressed, in inspiration, over *unexpanded lung*, while those parts over *expanded lung* will rise and fall with the motions of the chest in breathing. To be satisfied that respiration is fully established, one should see that no part of the chest wall sinks during inspiration.

Rate.—The child should now breathe about forty-five times to the minute, but the respiratory rhythm is likely to be irregular.

As *aids to effecting natural respiration*, slapping the buttocks, blowing on the skin, or alternate applications of hot and cold water are usually all that are necessary.

Circulation.—In this another *marked change* occurs. The umbilical vein and ductus venosus, leading from the umbili-

cus to the inferior vena cava, are closed, dwindling to a fibrous cord (the round hepatic ligament) in two to five days. The Eustachian valve, which guided the blood from the right auricle to the left auricle, disappears at once; the foramen ovale, through which the blood passes from the right auricle to the left auricle, closes in ten days, by a fold of endocardium growing over it from below; the ductus arteriosus, which carried the blood from the pulmonary artery to the descending aorta, becomes an impervious cord in four to ten days; and the umbilical arteries, which carried the blood from the internal iliacs to the navel, become the anterior vesical ligaments above, and remain as the superior vesical arteries below.

The *pulse* at birth varies from 140 to 120 per minute, and is frequently irregular. The higher rate is found in girls and small infants; the lower in boys and large infants.

Temperature.—At birth the *temperature* is about 99° F. It may sink rapidly directly after birth; but in the healthy child it soon returns to normal. The newborn infant is naturally very sensitive to cold, having lived so long in a temperature of 98° F., and great care must be taken to prevent chilling.

Skin.—Vernix Caseosa.—The child at birth is covered, to a greater or less degree, with a slippery, white substance, the vernix caseosa, a mixture of epithelium, down, and secretion from the sebaceous glands.

Lanugo.—In addition to the vernix caseosa, the skin shows an abundant growth of very fine downy hairs, the lanugo, which soon disappears.

Desquamation.—Shortly after birth the skin is frequently very red, and later decided desquamation may occur.

This desquamation and the frequent presence of rashes which appear during the early days of the infant's life are due to the irritation of the skin by the marked change in the surrounding medium. The warm fluid of uniform temperature of intra-uterine life is exchanged for an atmosphere of uneven temperature, and for the various mechanical and chemical irritants which come in constant contact with the delicate skin.

Length.—The average length is about 20 inches. Below eighteen is evidence of prematurity.

Weight.—Boys average 7½ pounds; girls, about 7 pounds. Below 5½ pounds shows a low vitality and suggests prematurity.

Head.—Measurements and Fontanelles.—The head measures about 13 inches in circumference in the occipitofrontal line. The *anterior fontanelle*, at the juncture of the coronal and sagittal sutures, is open 1½ x ½ inch. The *posterior fontanelle*, formed by the sagittal and lambdoid sutures, is also plainly to be felt.

Caput Succedaneum.—The head is apt to be much misshapen from pressure during its passage through the pelvis, and on one place is a thick, boggy swelling, the caput succedaneum, formed by serous infiltration into the tissues of the scalp over the part presenting in the birth canal, and hence escaping pressure. The caput disappears in a few days, and the shape of the head rights itself, both without assistance.

Thorax.—Measurements.—The average circumference of the chest at the nipple line is 13 inches, the same as that of the head, the anteroposterior and transverse diameters being about equal. With the addition of the shoulders, we have a decidedly larger-sized body than head, a point of importance in connection with the birth of the shoulders over the perineum.

Abdomen.—The average circumference of the abdomen is 14 inches. The navel represents the midline of the body's length, being equidistant from the top of the head and the sole of the foot.

Intestines.—At birth the intestines contain a very dark green, pasty substance called meconium, made up of bile, epithelium, intestinal mucus and lanugo. This is expelled in considerable quantities shortly after, and sometimes during birth; and, through the influence of the colostrom, for the next four days. It is found to be absolutely sterile and free from bacterial life.

The relative positions of the stomach and the colon differ from the positions of later life. The stomach is much more

nearly vertical, so that vomiting occurs more readily; the transverse and splenic portions of the colon form an oblique section extending almost directly from the hepatic flexure to the sigmoid.

Kidneys.—Urine.—Constantly, after birth, the bladder empties itself of a small quantity of limpid urine of low specific gravity.

Uric Acid and Urates.—In the kidneys themselves there are deposits of uric acid and urates, the so-called *infarcts*, crystals of which pass down the ureters and are found as pink or reddish-yellow stains on the napkin. They may be so large as to cause sharp pain in their passage down the ureters; this is sometimes the cause of prolonged crying spells in early infancy and shows the lack of sufficient water in the system.

Umbilical Cord.—Pulsation.—The umbilical cord should be found to be strongly pulsating at birth, and it is best to wait for this to stop before ligating. An exception to this rule is made in congestive asphyxia, where the withdrawal of some blood from the child is desirable. It has been found that when the cord has not been tied until after pulsation has stopped, the infant gains, on an average, 3 ounces of blood, and its initial loss of weight is lessened.

Ligation.—The cord should be tied 2 inches from the navel, very tight, with narrow, aseptic bobbin, and cut beyond with sterile scissors. Before leaving, the stump should be examined, as it is quite common to find it bleeding a little. Dress the stump with dry, sterile gauze, dusting with powdered bismuth. Some time within a week the cord should drop off by a process of dry gangrene, leaving a healthy ulcer at the base which is healed by the tenth day.

Bathing.—After tying and cutting the cord the infant should be *greased* thoroughly with oil or vaseline to soften the vernix caseosa, and laid aside in a warmed woolen blanket, with a soft towel next the skin, until the mother has been entirely attended to.

Then the baby should have a *general bath*, in a warm room, before an open fire if possible, in water of a tempera-

ture of 100° F. Castile soap, a soft sponge, and a soft towel should be the adjuvants. After drying, all the flexures and creases in the skin should be dusted with talcum or some similar dry powder.

Eyes.—Infection.—There is always danger of some form of *infection* to the conjunctivæ from the uterine and vaginal secretions. It is therefore wise to follow the *prophylactic treatment* introduced by Credé; first washing the eyes with clean water or saturated boric acid solution, and then instilling into each eye a couple of drops of 1 per cent. silver nitrate solution, being sure that the lids are open so that the silver reaches the whole conjunctiva, bulbar and tarsal. The baby should be kept in a darkened room the first few days.

Strabismus.—It is well to remember that coördinate movements of the eyeballs are imperfectly performed in infancy and hence *strabismus* is frequently present.

Mouth.—The mouth should be freed from mucus, liquor amnii, or whatever may have entered it during birth. This may be done by sweeping the finger, covered with soft, dry gauze, carefully and gently over the whole cavity, going well back into the pharynx. Sometimes it will be necessary to introduce a catheter into the pharynx and suck out a considerable quantity of mucus lodged there.

Examination for Abnormalities.—This examination should next be made, with special reference to the skin, head, spine, hands, feet, genitals, and anus. Examination for imperforate anus should never be neglected if the meconium does not appear in the first twenty-four hours.

Clothing.—This should be light, warm, unirritating, and should allow free movement of the body and limbs. A broad abdominal band should be worn until the navel heals completely. The other essentials are a woolen shirt, a flannel petticoat, a diaper and a dress. For night wear the dress is exchanged for a nightgown. Safety pins only should be used in fastening the clothing.

Babies are usually clothed too much, rather than too little, and in very warm weather fewer clothes than the above are needed.

Food. Colostrom.—Nature prepares no real food for the first two or three days, but during this time the breasts of the mother secrete *colostrom*, a thin, yellowish fluid, showing under the microscope the presence of large corpuscles in addition to a small number of the usual fat globules. This fluid is laxative in its action. Eight to ten hours after birth the baby should be put to the breast, and after this four times daily until the milk comes. This accustoms the baby to sucking, reflexly stimulates the uterus to contract, and hastens the discharge of the meconium.

If there really seems to be need of food, as in weak infants, a 5 per cent. sugar solution is a good form until lactation begins. Excessive crying, as if from hunger, in a healthy baby can usually be stopped by simply giving boiled water.

Sleep.—The child should sleep almost continuously during the first few days. From the very start, training in good sleeping habits should begin. The baby should be taken up only to be washed and nursed, and taught to go to sleep when laid down. It should sleep in a crib by itself. No walking or rocking it, pacifiers, or other means of momentarily quieting should be permitted.

Premature and Delicate Infants.—An infant is said to be premature if born between twenty-six weeks' gestation and full term. Few babies born at twenty-six weeks survive, and every week of intra-uterine life thereafter increases its chances considerably. Aside from the fact of prematurity, these babies are often weak and undeveloped from the same cause as produced the premature birth, as illness or malnutrition of the mother.

The length and the weight are usually more reliable as evidences of viability than the supposed term in weeks. Infants weighing only 2 pounds have survived. But a viable infant usually measures at least 31 cm. in length, and weighs 3 pounds; most of them with these proportions die in spite of every care. Length is of more importance than weight, and vigor of the infant more important than either.

The vitality of premature babies is naturally very low,

but the powers of heat production, digestion and respiration are least developed and need most attention. In *treatment* the most difficult problems are to properly nourish them and to maintain the animal heat. They should not be bathed but should be cleansed with oil and the body wrapped in cotton, all but the face being included. Warmth is maintained by wrapping in blankets, placing in a well-protected basket, and surrounded by hot-water bottles. The temperature of the room should be between 85° and 90° F. In the home this plan is better than the use of incubators. In hospitals a special room is arranged, much on the plan of the incubator, and in this the best results are obtained.

Feeding should be breast milk when possible, from the mother or a wet-nurse. The mother cannot supply milk unless the infant has had about eight months of intra-uterine life. The milk must be pumped from the breast and given in small quantities, from $\frac{1}{2}$ to $\frac{3}{4}$ ounce every hour and a half or two hours. This is usually best done by feeding with a medicine dropper without removing from its "nest." Gavage may be necessary. If breast milk cannot be obtained, the next best food is modified cows' milk, with a formula of fat 1 per cent., proteid 0.5 per cent., and sugar 7 per cent. This should be increased in strength gradually as the child's condition warrants it.

CHAPTER II.

NORMAL DEVELOPMENT OF THE INFANT.

Weight.—During the *first year* the child should be weighed every week, and during the second year every other week. The gain or loss in weight from one weighing to another is the very best indication we have of the general welfare of the child. Frequently the first signal of beginning trouble is the absence of the regular weekly gain, or the presence of a slight loss.

Physiological Loss.—During the first three days of life there is a so-called physiological loss in weight, averaging about 10 ounces. This is due to loss of urine, meconium, and vernix caseosa, and the lack of food the first few days. With the advent of milk in the mother's breast, the normal gain begins, and, by about ten days, the birth weight should be regained.

At *six months* the birth weight is about doubled, and at the end of a year about trebled. During the first six months the gain should average 4 to 8 ounces per week; and from 2 to 4 ounces during the second six months. From 4 to 6 pounds per year is about an average gain for the next ten years.

Sickness of any kind, and particularly digestive disturbances, stop the normal gain, and usually substitute a loss. Even the physiological process of *dentition* is often accompanied by a diminished weekly gain.

Height.—During the *first year* the growth is about 8 inches, an average of $\frac{2}{3}$ of an inch per month, the increase being somewhat greater during the first quarter. During the *second year* the growth is about 4 inches, and during the *next ten years* it averages about 2 inches per year. This growth, in infancy, takes place more rapidly in the extremi-

ties than in the trunk, although at birth the trunk was relatively longer than the limbs.

Head.—During the first year the *occipitofrontal circumference* of the head should increase about 4 inches, and about 1 inch more during the second year. A gain of $1\frac{1}{2}$ inches more should take place by the fifth year, at which time the head attains a size only 1 inch less than that of the adult.

The *cranial sutures* ossify by the sixth month, the posterior fontanelle closing by the second month, but the anterior not till the eighteenth month, having often increased some in size during the first nine months. *Early closing* fontanelles and sutures suggest premature ossification, or cerebral defects; while fontanelles and sutures *remaining open overtime* are suggestive of rickets or hydrocephalus.

Thorax.—The thorax grows more transversely than from before backward, keeping pace with the growth of the head, and not until the third year is it distinctly larger than the head. A chest of a three years' child not larger than its head points to extreme delicacy.

Abdomen.—The abdomen at birth is larger than either the head or chest; at two years it should be about the same size, and afterward the smallest of the three.

Muscular Acts.—Voluntary but incoördinate *muscular movements* are made about the fourth month. The head is held erect about the same time. The child sits erect about the seventh month. The first attempts at walking are made about the twelfth to the fifteenth month, some children learning to cre p three or four months earlier.

Pulse.—The *force* and *rhythm* in infancy are the important factors rather than the rate. During the first year the frequency varies from 110 to 140, reaching 100 by the end of the second year. By the eighth year the adult rate is present. The rate is markedly influenced by very trivial causes, such as crying, struggling, or excitement, making its value unimportant. It is helpful to remember that the pulse can be easily counted in the anterior fontanelle.

Respiration.—Respiration is chiefly *abdominal,* and the rapidity very variable. During sleep it averages consider-

ably less than during wakefulness. The *rate* in the *first months* is 35 to 40; during the second year it falls to 28; during the third, to 25; and by puberty it reaches the adult rate, 18 to the minute.

In health the rhythm—inspiration, expiration, pause—is unchanged. The ratio between pulse and respiration is about $3\frac{1}{2}$ to 1.

Temperature.—After the more or less *marked fall* succeeding birth the temperature immediately assumes the adult range, the main point to be kept in mind being the extreme fluctuations under slight causes, the heat centres being very unstable. In the chronic wasting diseases a subnormal temperature is quite common.

Dentition.—At *birth* the teeth are enclosed in the dental sacs in the alveoli of the jaws, and their growth is outward by calcification of their roots, this growth beginning at birth.

The *milk* or *deciduous teeth* are 20 in number, and are cut in the following order, although quite wide variations are frequent:

(1) Two lower central incisors, at six to nine months. (2) Four upper incisors, at eight to twelve months. (3) Two lower lateral incisors and four anterior molars, at twelve to fifteen months. (4) Four canines at eighteen to twenty-four months. (5) Four posterior molars, at twenty-four to thirty months.

Early teething usually means early ossification of the cranial bones; and late teething usually means rickets, or other form of malnutrition.

In a *healthy child* dentition is usually not accompanied by any constitutional disturbance, the tooth very gradually forcing its way through the overlying gum by a process of pressure absorption, first showing its presence as a lump under the reddened mucous membrane, this growing whiter as the tooth nears the surface.

If any symptoms are present, they are only restlessness, fretfulness, disturbed sleep, salivation, a disposition to put objects into the mouth, and possibly a little fever.

In previously *unhealthy children* more serious *symptoms* may coincide with dentition, such as vomiting, diarrhea,

fever, earache, eczematous eruptions, and possibly convulsions; but there is always the question whether the unhealthy condition as a predisposing factor is not more of a cause of the symptoms than the teething. The more carefully other causes are looked for, the fewer cases due to dentition only, even in these susceptible infants, will be found. Rarely, a case calling for lancing the gums will be discovered.

The *second* or *permanent teeth* are cut as follows: (1) First four molars, at six years. (2) Eight incisors, at seven to eight years. (3) Eight tricuspids, at nine to ten years. (4) Four canines, at twelve to fourteen years. (5) Second four molars, at twelve to fifteen years. (6) Third four molars at seventeen to twenty-five years. Except for the first four molars, the order is about the same as for the first set. In growing, the second set cause atrophy of the roots of the first set until they loosen and fall out.

Urine.—For obvious reasons accurate results as to the quantity of urine in infancy are hard to obtain. During the first few days of life the daily quantity is 3 ounces; by two months it increases to 8 to 10 ounces; by six months to 10 to 16 ounces; by two years to 20 ounces; by five years to 26 ounces; by eight years to 40 ounces; and by 14 years to 48 ounces. The specific gravity averages from 1.005 to 1.010. The reaction is acid. Traces of albumin or of sugar may be found during certain periods, but rapidly disappear.

The Feces.—These partake of the characteristics of *meconium* for four or five days, when they change to *milk stools*. These are yellow, of the consistence of semisolid butter, smooth, of acid reaction, and inodorous. The *gases* present are hydrogen and carbonic acid. The feces amount to about 3 ounces per day in quantity, and are passed from two to four times daily. Chemically they consist of 85 per cent. of water, and of fat, proteids, lactic acid, salts, and bile elements. Bacteria are present in large variety, especially the Bacillus coli communis. Stools resulting from cows' milk are whiter, from the presence of more curds. When the child begins a mixed diet, the stools assume the adult type.

Special Senses. **Sight.**—This is present from birth and in the first week the eyes are very sensitive to light. Not till the fourth month do they seem to be used voluntarily.

Hearing.—Deafness is present for a day or two. This is probably due to the absence of air from the tympanum, but when respiration is well established, the hearing begins, and it is then extremely acute. The infant does not seem to locate sounds before the fourth month.

Touch.—Sensation is present, but is dull for three months. It is highly developed in the tongue and lips, where the temperature sense is also acute.

Taste.—This sense is highly developed from birth.

Smell.—We know scarcely anything about the ability of the newborn infant to distinguish odors.

Speech.—This function is very variable in its development. Very much depends on efforts at training, as institution children always talk much later than those brought up at home. By the end of the first year, the child should begin to say a few words, and by the end of the second year should form a few sentences. If there has been no effort at speaking by the end of two years, probably some mental defect is present or "deaf-mutism" may be suspected.

CHAPTER III.

EXAMINATION OF THE CHILD.

History.—The family history should be carefully ascertained as a matter of routine, and then the personal history of the child. Ascertain if the birth was prolonged, precipitate, or instrumental; if previous pregnancies were abnormal, stillbirths, premature, etc. Particularly inquire about the feeding from birth, especially early feeding and most recent. Try not to ask questions that may be answered simply by "yes" or "no." Gather together systematically all the facts about the present illness; ask if the child has had similar attacks of the same nature. Be willing to listen patiently to all ideas and observations of the mother or nurse about this and previous illness.

Inspection.—Observe the child carefully without touching or disturbing it, particularly if an infant. Notice the position, whether it is natural and easy, and whether movement of arm and leg is the same on the two sides; if asleep, whether sleep is quiet or restless; the respiration; the color of the skin, and if moist or dry; the facial expression, mouth open or closed when quiet; the nostrils, whether quiet or moving; the character of the cough, if any; the cry, whether whining or lusty, occasional or constant; the condition of the eyes and pupils; look for enlarged lymph glands; irregular muscular movements or twitchings; discharges from nostrils, genitals, etc. Compare the impression, as much as you can, with that given by the normal infant.

Physical Examination.—In every instance make first that portion of the examination which will disturb the child the least, and let all handling be deliberate and gentle. Do not touch the bare body of a child with cold hands or cold instruments. The child should be stripped and examined

first for eruptions; this can always be done best by daylight. Palpate the abdomen with gentle touch, remembering that normally the liver can be felt below the ribs in young children, and that the spleen cannot be felt. Auscultate and percuss the chest carefully, being sure that the child is in such position that the two sides are symmetrical; note the movement of the two sides and compare the fremitus. Inspect the genitals and examine any discharge for the presence of gonococci. Examine the bones for irregularities, and the extremities for any points of pain or tenderness. Ascertain the firmness and development of all the muscles. Investigate the mental development and the efficiency of the nervous system in general; if the fontanelle is open, see if it is bulging, flat or depressed. Make any measurements that seem indicated. Take the temperature, if possible, in the rectum, as that is the most reliable. The pulse should be counted, but its rate in children is of comparative unimportance. Examine carefully the ears, mouth, and above all never fail to examine the throat. This should usually be the last proceeding, as it is almost certain to make the child unmanageable.

Laboratory Aids. The von Pirquet test should be made if there is any suspicion of tuberculosis. The Wassermann, in any case that might be syphilis. It is best to examine a culture for diphtheria in every doubtful case of sore throat or nasal discharge. In cases of suspected meningitis a lumbar puncture is of inestimable value and does no harm. Blood counts and blood smears will sometimes set one on the right track when nothing else will; employ their aid frequently. And the urine examination should never be neglected when there is any obscurity about the illness.

CHAPTER IV.

DISEASES OF THE NEWBORN INFANT.

ASPHYXIA.

Forms.—There are two distinct forms of asphyxia after birth: (1) The congestive, and (2) the anemic. In the first the child is livid in color, appears swollen, and has good muscular tone and a full, strong pulse. In the second form the skin is pale, the muscles flaccid, and the pulse inappreciable.

Prognosis.—The prognosis in the congestive variety is far better than in the anemic.

Treatment.—This is simple in the former; first allowing a little blood to escape from the cut cord to reduce the internal congestion, and then alternately dipping the baby into hot water (110° F.) and cold water. The reflexes being still present, the response is marked.

In the latter variety allow the child to get as much blood as possible from the placenta, and then perform artificial respiration, for a long time if necessary, at the rate of ten to fifteen times per minute. Sylvester's method is undoubtedly the best, as the baby can be kept in a tub of hot water during the manipulations. Be sure that the mouth and pharynx are clear of any foreign substance.

In some cases when artificial respiration fails, *direct inflation* of the lungs by the mouth-to-mouth method, the pulmotor, or by passing a catheter into the larynx, succeeds. In these cases, after respiration is established, attention is necessary for some time to prevent relapses and to be sure that atelectasis is overcome.

ICTERUS.

This common affection, of still unknown origin, appears from the second to the fifth day and lasts about a week.

It occurs in about one-third of all newborn infants. It is probably hepatogenous in origin and due to resorption of bile pigment. It requires no treatment, disappearing without other symptoms in a few days.

In some cases an early jaundice *increases in intensity* and presents constitutional symptoms. In these cases the *prognosis* is bad, and there is usually either a septic infection from the umbilical vessels or a congenital malformation of the bile ducts.

OPHTHALMIA.

Definition.—This is an *infectious conjunctivitis*, in the majority of the cases due to the gonococcus, less frequently to the ordinary pyogenic germs. All degrees, from a mild conjunctivitis to chemosis, corneal ulceration, and often total blindness, may occur. Gonorrheal ophthalmia is a very common cause of blindness.

Symptoms.—Redness, swollen lids, *copious purulent discharge*, pain, and photophobia usually are present.

Treatment.—Prophylaxis, as already described, is most important. After the disease is started, frequent and thorough cleansing with a saturated boric acid solution, normal saline, or sometimes 1 to 5000 bichloride of mercury, is the most important item. Twice a day a few drops of a 1 per cent. solution of silver nitrate solution should be instilled into the affected eye or eyes, and in the intervals ice-cold compresses, frequently changed, should be kept on the lids. If only one eye is affected, it is important to put a shield of some sort on the other to prevent its infection. It is always wise to call in the services of an oculist.

CEREBRAL HEMORRHAGE.

Source.—A quite frequent accompaniment of birth is some form of bleeding within the skull, which is regularly from the congested vessels of the pia mater. These hemorrhages are mostly mechanical, and are seen in prolonged non-instrumental births quite as frequently as after the use of forceps. The hemorrhage is situated usually at the base and nearer

the back than the front of the brain. They occur in both breech and vertex cases.

Symptoms.—If the hemorrhage is large, the baby is often stillborn. If smaller, asphyxia, torpor, irregular respiration, feeble, slow pulse, and convulsions are the regular symptoms. The pupils are variable, but oscillatory movements of the eyeballs are frequent. According to the size and location of the clot, localized or nearly complete spastic paralysis is present. In the surviving cases permanent damage to the brain and the supplied parts is left. These permanent symptoms depend on the location of the lesion, and may be idiocy, epilepsy, diplegia, hemiplegia, or monoplegia.

Treatment.—The most important point is prevention in shortening long labors by the judicious use of forceps. For the changes left behind by these accidents very little can be done. Recently a number of cases have been operated on soon after birth for the removal of the clot; the results are as yet unconvincing, but the operation is advisable, as these cases are otherwise hopeless.

CEPHALHEMATOMA.

Definition.—This is an extravasation of blood under the pericranium, and is due to some traumatism during labor.

Symptoms.—There is a tumor present on some portion of the scalp. This is always limited by the attachment of the pericranium, and therefore never passes over a suture or fontanelle. It appears from the first to the fourth day, and gradually grows for about a week, when it slowly begins to disappear. It is fluctuating but shows none of the signs of inflammation. As it grows older there is a firm, raised ridge around the margin due to the organization of the effused blood and, sometimes, the formation of minute particles of bone. It frequently gives the impression of a depressed fracture of the skull. If the scalp is lacerated over it, infection is likely to occur, followed by abscess. The whole tumor will disappear in two or three months by a process of absorption, unless some accident befalls.

Treatment.—Care should be exercised to protect the part from injury, and to keep aseptic any abrasions of the skin in the neighborhood. Non-interference is otherwise the proper course. If an abscess forms, open and pack.

OBSTETRICAL PARALYSES.

The two most common forms of obstetrical palsies are: (1) *Facial*, and (2) *brachial*. The *former* is due to pressure on the facial nerve by one blade of the forceps. The eye on the paralyzed side remains open, and in moving the face this side is found to be smooth, and the mouth is drawn to the sound side.

Treatment.—Generally none is needed, as the condition usually disappears within a week. In those cases where no improvement appears within a month, regular electrical treatment should be given.

Brachial Paralysis.—In brachial, also called *Erb's paralysis*, one or more groups of muscles of the upper extremity are paralyzed. Here also the cause is usually traumatism from the forceps, or pulling on the arm, or traction in the axilla; the great majority occur in breech presentations. The muscles most often affected are the deltoid, biceps, brachialis anticus, supinator longus; less often the supra- and infra-spinatus. The arm hangs flaccid, and after some time the muscles atrophy.

Treatment.—Most of these cases also recover spontaneously in a few months, but this can be hastened by electrical treatment. Strychnine is a useful drug in both forms. If the paralysis is permanent, anastomosis of nerves should be tried, using other unaffected nerves.

SEPSIS.

Sepsis in the newborn presents a great variety of manifestations. The infection by pyogenic bacteria commonly takes place through the umbilical wound, but any abrasion of the skin or mucous membranes presents an avenue of infection.

Symptoms.—These vary from those of a slight, local infection to those of a severe or fatal general septicemia. It may be a simple infection of the umbilical wound (omphalitis), or by extension become an umbilical phlebitis or peritonitis; it may be localized in any, or in several, of the tissues of the body, as the lungs, pleura, peri- or endocardium, meninges, bones, joints, intestines; cellulitis and erysipelas are two important manifestations. The general symptoms are irregular fever and its concomitants, rapid, feeble pulse, wasting, stupor alternating with restlessness, diarrhea, and vomiting. Hemorrhages are frequent, and it is in these cases that severe forms of jaundice occur.

Treatment.—Prophylaxis is most important in the aseptic care of the navel, and of any abrasions of the skin. When suppuration has begun, general supporting and stimulating measures should be used—in other words, proper food and whisky. Any local abscesses should be opened and drained.

The value of the use of vaccines in the treatment of sepsis of the newborn has not yet been conclusively demonstrated. They are undoubtedly of great benefit in other conditions, notably furunculosis, and should be employed in those cases of sepsis that do not show improvement with other means. The very severe cases offer little time for the employment of this therapeutic measure. It is, of course, necessary to know what organism is causing the infection in order to use the proper vaccine. The use of vaccines will be taken up more in detail in a later chapter.

TETANUS.

Definition.—This is an acute infectious disease, caused by the bacillus of tetanus, and is characterized by tonic muscular spasms affecting first the muscles of the jaws (masseters), next the muscles of the back of the neck, and later all the voluntary muscles of the body. The infection usually gains access at the navel, but any open wound may allow its entrance.

Symptoms.—These begin usually about the time of the separation of the cord; rarely later than two weeks. First

there is rigidity of the jaws, made noticeable by the difficulty in nursing. Later the body becomes rigid at intervals, complete relaxation taking place between spasms. As the disease progresses rigidity becomes nearly constant, particularly that of the jaws. This spastic condition is easily induced by slight external irritants, as sudden noise, jarring, or manipulation; this is due to the fact that the reflex irritability of the spinal nerves is very much increased. Later, general tonic spasms with opisthotonos supervene. The temperature at first is normal; within two or three days it rises, being then from 101° to 106° F., according to the severity of the case. Death is caused by exhaustion, or by suffocation from spasm of the respiratory muscles.

Prognosis.—It is a very fatal disease, the mortality being from 90 to 95 per cent.

Treatment.—Prophylaxis, by surgical cleanliness in the care of the cord or any wound, is most important. When tetanus has developed, the patient should be kept deeply under the influence of chloral and bromide, they being pushed to their physiological limit. Inhalation of chloroform, if used with great care, may be necessary to control the spasms. The most complete quiet should be maintained in the room and in the neighborhood of it. Feeding by a catheter through the nose may be necessary. As this is quite sure to produce spasms, the sedatives should be pushed at this time. Tetanus antitoxin will prevent the disease if given before the symptoms appear; its value after the onset of symptoms is extremely doubtful, and it is therefore of little value in the tetanus of the newborn. It should be given the benefit of doubt, and is best used injected into the vein or spinal canal.

EPIDEMIC HEMOGLOBINURIA.

Winckel first described this disease in 1879. Its essential *symptoms* are brown, smoky urine, with icterus and cyanosis, the cases occurring in epidemics. It begins three or four days after birth, and death takes place in about two days.

It is almost always fatal; probably it is an acute infection and should be classed under the head of sepsis.

Treatment is of no avail.

MELENA.

Definition.—By this term is meant hemorrhage from the navel, stomach, intestines, mouth, or indeed any part of the body. The term itself means bleeding from the alimentary tract, causing the pitch-black stools. In female infants bleeding from the uterus occasionally occurs, without other alarming symptoms, and stops spontaneously in two or three days.

Symptoms.—The bleeding begins usually in the first week of life. It is usually a constant oozing, and may be so considerable as to cause death within a few hours. Nearly always the bleeding is from more than one source. Prostration is marked and begins early, and there is a rapid loss of weight in all cases. Often the visible amount of blood lost is only a few drachms.

Prognosis.—This is serious, but not always fatal, depending on the extent of bleeding and the vitality of the child. Until recently the mortality was about 70 per cent.

Treatment.—The most effective measure, and the one to be tried in every case, is the injection under the skin of blood serum from an adult; prepared horse serum is marketed for the purpose and may be used. From 10 to 20 c.c. should be used three times a day and continued until bleeding stops. In desperate cases transfusion of blood may be successful. The value of drugs is doubtful, but the most rational one is epinephrin, the suprarenal extract; this is given internally, 2 grains every two hours. Special attention should be paid to the general nutrition.

PEMPHIGUS.

Definition.—This is a condition associated with eruption of bullæ on the skin, occurring in the first few days of life. There are two general varieties which it is very important to differentiate:

1. The form occurring as one of the manifestations of syphilis. Here the diagnosis rests on other evidences of the disease, the presence of bullæ on the palms and soles, the generally miserable condition of the infants, and the history of the parents. The Wassermann test should be done on mother and baby if syphilis is suspected. They usually die very promptly if syphilitic.

2. The form characterized by bullæ located on various parts of the body, especially the trunk, and which seems to be infectious in nature. It is quite evidently closely related to the impetigo contagiosa of older children. The lesions appear slowly at first and then rapidly, spreading and coalescing until the appearance is that of an extensive burn. It is fatal in more than half the cases, and in the severe ones *treatment* is useless. In more protracted ones the bullæ should be opened, drained, and washed with 1 to 5000 bichloride solution; dressings should be kept on raw areas, using antiseptic ointment or powder.

GRANULOMA OF UMBILICUS.

This is a little *lump of granulations* left after the sloughing of the cord, and causing a purulent discharge. At times there may be associated with it a *patent urachus* leading to the bladder, and hence a few drops of urine may ooze from the navel.

Treatment.—It is best snipped off with scissors and the base touched with solid nitrate of silver.

UMBILICAL HERNIA.

This form of rupture usually appears through the opening in the linea alba that admits the umbilical vessels, and before the third month of life. It varies in size from a simple convexity of the navel to a tumor large enough to become strangulated.

Treatment.—For a cure a mechanical application is usually all that is required. It is best held back by adhesive plaster strapped across the abdomen with an ordinary wooden button

over the ring, acting as a pad to prevent protrusion. If this is worn constantly for three to six months, the hernia is regularly cured. A well-fitting truss must be worn in bad cases and in those whom the plaster causes great irritation.

MASTITIS.

A slight degree of *inflammation of the breasts* is fairly common in newborn infants of both sexes.

Etiology.—Traumatism and lack of cleanliness.

Symptoms.—These are pain, tenderness, and the secretion of small quantities of a milky fluid.

Treatment.—Apply cool, clean compresses, and above all things do not rub nor squeeze the breasts. They may be painted with tincture of belladonna if the inflammation is severe.

SCLEREMA.

This is a condition of hardening of the skin and subcutaneous tissues, either in circumscribed areas or diffused over the body. It occurs in feeble, poorly nourished babies, and is generally fatal. It is associated with marked lowering of the cutaneous temperature of the body, and it is probable that the condition is due to the hardening of the subcutaneous fat due to this low temperature. It is differentiated from edema by the fact that there is no pitting on pressure.

Treatment.—Artificial heat and proper nutriment are all we can supply to assist these cases. The use of the incubator is often valuable.

CRANIAL ABNORMALITIES.

All degrees of malformation of the brain and cranium may be seen. They vary from the condition of anencephaly and microcephaly to simple idiocy without noticeable abnormality of the brain or cranium. As these conditions are due to a lack of substance or to improper development there is, of course, no treatment for them.

FIG. 1.—Anencephaly. Child, ten days old, and apparently thriving. The tumor is due to a large defect in the bone and the small amount of brain tissue is covered with parchment-like tissue which has already begun to ulcerate. (St. Louis Children's Hospital.)

FIG. 2.—Same as Fig. 1. (Front view.)

HYDROCEPHALUS.

Varieties.—This condition, called water on the brain, is of two varieties, *external* and *internal*.

The *former*, in which the increase of fluid takes place in the arachnoid space, between the brain and dura mater, is quite rare. The *latter*, with the fluid in the cerebral ventricles, is the common form, and is the one described.

Etiology.—Internal hydrocephalus may be due to a congenital malformation, or to an inflammatory exudate, and may therefore be either congenital or acquired. The cause of the accumulation of fluid is a mechanical one in which the flow of the cerebrospinal fluid from the ventricles into the spinal canal, or from the canal into the tissues without, is obstructed.

The fluid closely resembles normal cerebrospinal fluid in character and may be present in quantities from ½ pint up to 2 quarts or more. The ventricles are dilated and the brain is thinned by pressure, at times being a mere sac.

Symptoms.—The *cranial sutures* are wide open, even those at the base in marked cases. The fontanelles are open and bulging, the head is enlarged, the forehead is high, and the face seems comparatively small. The scleræ of the eyes show above the corneæ in a manner that is quite characteristic. Fluctuation can be obtained, and even *translucency* can be demonstrated in marked cases. The head cannot be held up, the *mental condition* is dull, and there is a general laxity of the muscles, although there may be a noticeable rigidity of the arms and legs. *Nystagmus*, *strabismus*, and *inability to close the upper lid over* the ball of the eye are often present. Convulsions usually occur at some time in the course of the disease, generally toward the last.

When the head enlarges greatly *in utero*, birth may be impossible without perforation of the cranium and withdrawal of the fluid.

Prognosis.—Recovery is rare. When the process ceases and the child grows up, some mental defect is usually present.

Treatment.—This is very unsatisfactory. If there is suspicion of syphilis, mercury and potassium iodide may be

tried. Various operative procedures have been used, of which aspiration is probably the best; but all are of doubtful value.

MENINGOCELE.

Definition.—This means a *protrusion* of some part of the membranes of the brain through a hole in the cranial wall, usually in the location of a suture or fontanelle. The tumor contains a portion of the meninges (meningocele), or meninges and a portion of the brain substance (encephalocele), or both of these with an inner cavity containing fluid, which communicates with the lateral ventricles (hydrencephalocele).

Symptoms.—The tumor is always congenital: it usually fluctuates, pulsates, gives an impulse or actually increases in size on coughing and screaming. Attempts at reduction usually cause cerebral symptoms. It is most often situated in the occipital region, or at the root of the nose. The child frequently has other deformities associated.

Treatment.—Protection and compression are the most important measures. Aspiration and injection of the tincture of iodin is indicated if fluid is present. Very little can be hoped for from operation. Few cases recover, hydrencephalocele never.

SPINA BIFIDA.

Definition.—This is a protrusion of the spinal meninges, or other of the spinal contents through the wall of the canal. Usually it is posterior, through some bone defect; but it may be anterior, and the tumor project into the thorax or abdomen (spina bifida occulta). The posterior variety may be perfectly covered by skin, or may have a central area of parchment-like membrane which easily breaks down and ulcerates.

Symptoms.—The tumor is present at birth. It is most common in the lumbar region, next in the sacral, and least often in the cervical. It fluctuates, is elastic and compressible, and is usually increased by crying or by pressure on the anterior fontanelle. If the cord elements are in the sac (meningomyelocele or syringomyelocele) paralysis of

the legs and of the bladder and rectum is present. The tumor has a tendency to grow, occasionally becoming very large, and eventually may ulcerate and burst, death following from infection.

Prognosis.—If no paralysis coexists, complete recovery may occur; these are usually cases of true myelocele, and occur most often in the cervical region. If paralysis is present the prognosis is bad; these are cases of meningo- or syringomyelocele, usually located in the lumbosacral region.

FIG. 3.—Low tumor of spina bifida. This is the least favorable location of the defect. (St. Louis Children's Hospital.)

Treatment.—Protect the tumor from pressure and traumatism, and if not entirely covered with skin it must be kept scrupulously clean. Operation is indicated in the milder forms, usually the cervical, but good judgment must be used in selection. Excision of the sac is the proper operative procedure.

HARE-LIP—CLEFT-PALATE.

Definition.—This deformity is due to the imperfect closure of the maxillary and intermaxillary processes in embryonic life. It may be only a slight indentation of the lip, or a fissure extending into the nostril; this is hare-lip, and may

be single or double. In addition there may be, usually with double hare-lip, a fissure of the soft palate which may extend into the hard palate. The deformity is unsightly and prevents the infant from sucking properly.

Treatment.—Medical care is concerned principally with feeding and cleanliness of the mouth. The baby can be fed with a spoon, dropper, or by gavage if necessary. Fixing a leaf-shaped piece of sheet rubber on the nipple to cover the palatal defect sometimes permits the baby to nurse a bottle.

Permanent relief, of course, is surgical. The operation for hare-lip is preferably done in the second or third month; that for cleft-palate at two to four years.

OTHER DEFORMITIES.

Club-foot.—This deformity, usually of the equinovarus variety, is often congenital. It belongs in the province of the orthopedic surgeon, but is mentioned here to call attention to the importance of immediate treatment; the sooner the better. By massage, manipulation, and a simple apparatus the parts can usually be brought back to their normal relations in the early weeks of life; later more complicated apparatus and surgical interference is necessary.

Imperforate Rectum.—This is a fairly frequent defect and is, of course, recognized by the failure to pass the bowel contents. The closure may be at the anus or higher up. The low cases are easily operated on by breaking through the septum with a blunt instrument. The higher operation requires more care. If the lower end of the bowel is too high to reach from below, or cannot be found on dissection, the only recourse is an artificial anus in the groin.

Hypospadias.—This abnormality of the *urethra* is the commonest of the congenital defects of this region. The canal, instead of opening at the end of the glans penis, opens anywhere on the under surface, from the sulcus just behind the glans to the penoscrotal junction. When the opening is far back in the perineum, the scrotum may be divided into two halves, giving rise to the condition known as false her-

maphrodism. The farther forward the urethra opens, the less disagreeable to the patient the condition is. There is nothing serious to be feared from it, but in adult life it may be the cause of sterility.

Treatment.—Treatment is purely surgical, the operation being a plastic one for the formation of a new urethra from the end of the natural one to the end of the glans penis.

Epispadias.—This is a much rarer condition of urethral abnormality, the opening here being somewhere on the dorsum of the penis. It is also unimportant from the standpoint of the patient's life, but may be a source of great inconvenience, and also a cause of sterility.

Treatment.—Treatment is purely surgical, as in the preceding defect.

Exstrophy of the Bladder.—This is one of the most distressing deformities of the newborn infant. The anterior bladder wall, to a greater or less extent, is wanting, due to incomplete closure of the abdominal plates. The ureteral openings are usually in plain sight. The urine drips away continually, wetting the clothing, excoriating the skin, and producing, by its fermentation, a most disagreeable odor. The person is objectionable to himself and to all around him. The abnormality, which is really only a much exaggerated epispadias, is also harmless as far as life is concerned.

Treatment.—Only a complicated plastic operation can cure these unfortunates. This should always be undertaken, and the results are often successful. There is no reason why this operation should be postponed more than five or six months.

Cryptorchidism.—The testicles should descend, from their abdominal location of embryonic life, into the scrotum by the eighth month. Frequently one or both testicles may remain in the abdomen at birth or descend only into the inguinal canal. Ordinarily they will, without interference, finally reach the scrotum in the course of a few weeks. If they remain in the abdomen, no harm can come to them; but if they remain in the inguinal canal, they are subject to traumatism, and may become inflamed and be the source of great pain.

Treatment.—If the testicles remain in the abdomen, nothing should be done. If they remain in the inguinal canal, they should be protected from injury as far as possible. Sometimes by gentle manipulation they can be assisted in descending to their proper place. If they become inflamed, they should be treated by rest and cold applications. If they will not descend, operation should be performed either to transplant into the scrotum or, if this is impossible, into the abdomen.

CHAPTER V.

FEEDING OF INFANTS.

WOMAN'S MILK.

Characteristics.—All observers agree that a healthy woman's milk is the best food for a child during the first year of life. When this is not available, the food that is substituted for it should be as similar to it as possible. It is important, therefore, to make a careful study of normal human milk.

Woman's milk is a secretion of the mammary gland, formed by the metamorphosis of the cells of the acini. It consists largely of water, holding in solution or suspension four different kinds of solids—proteids, fat, sugar, and salts. It is a thin, odorless, sweetish fluid, with amphoteric reaction (but more alkaline than acid), and having a specific gravity from 1.029 to 1.032. Its appearance is the same as that of cows' milk.

Chemical Composition.—The average proportions of the different constituents are as follows: proteids, 1 to 2 per cent.; fat, 3 to 4 per cent.; sugar, 7 per cent.; salts, 0.2 per cent.; water, 87 to 88 per cent.

Considerable variation occurs in different specimens of milk from different women, or in milk from the same woman taken at different periods, or indeed at different times in the same day. The greatest variation is in the fat, which may normally be as high as 6 per cent. in a single nursing, but throughout the period of lactation the average will usually be very close to the above figures. In the first two weeks and in instances of prolonged nursing marked differences occur, consequently nursing longer than one year is unwise.

Proteids.—These are the albuminous constituents of milk. There are two varieties, soluble and insoluble. Casein is

the insoluble one, and the one that forms the curd when precipitated. It is held in suspension by means of calcium phosphate and can be seen by use of the ultramicroscope as fine particles moving between the fat droplets. The soluble proteids are lactalbumin and lactoglobulin, these resembling the albumin of the blood. They are present in about the same amounts as casein; that is, there is about one-half soluble and one-half insoluble proteid. Proteid is the food that furnishes the nitrogen to the child for the growth of the nitrogenous tissues of the body. It is absolutely essential for growth, fats and carbohydrates being mainly of value to supply energy and heat. The proper amount is therefore a prime necessity, and an infant deprived of the proper quantity will become weak, anemic, emaciated, with small, flabby muscles and slight resistance.

Fat.—The fat of milk is the familiar cream and it is present as an emulsion of minute droplets of rather various sizes. When examined under the microscope, they should be the only visible elements (the casein being visible only by means of the ultramicroscope) and appear as round, thickly aggregated and highly refractive granules.

The fat is of use mainly as a source of heat and energy, and in supplying the fat layer that surrounds and protects certain other tissues. From clinical experience it seems quite certain that it has a decided effect on the growth of the bones, as most babies with marked rickets have been given too little fat. While it is not as essential to growth and development as the proteids, still prolonged deprivation of it is followed by manifest anemia and signs of malnutrition. Constipation is very frequent in such cases.

Sugar.– This is the most constant in quantity of all the ingredients except the salts. It is the carbohydrate element and is present as lactose (milk-sugar) in solution in water.

It is of value principally in the production of heat and energy as is the fat; it is also readily converted into fat and stored as such in the body. As it is readily fermented by bacteria, it plays a great part in the production of gas in the intestines, and great excess in the food may cause marked acidity of the stools, due to the acids formed in fermenta-

tion. A large excess of sugar in the food often makes a rapid increase in the child's weight, but if the other food elements are lacking, such children are not strong and resistant and readily fall victims to acute diseases.

Salts.—These are the mineral ingredients or "ash" of the milk, consisting mainly of calcium phosphate, potassium carbonate, sodium chloride and small amounts of iron, magnesium, and sulphur. They play a much more important part in digestion than was formerly realized, and indeed their action is still very obscure. Certain intestinal disturbances are due directly to the salts, and the lack of them makes the other food constituents more difficult to digest. They are, of course, the great source of nutriment for the growth of bone and are present in every fluid and tissue of the body.

Water.—This is necessary in such comparatively large amount to hold in solution or suspension the various food elements, that they may be more easily digested. It is necessary to the body in large amounts to supply the water necessary in absorption of the digested food, and to carry off the excreted waste materials. The infant needs five times as much water, in proportion to its weight, as the adult, and must be given, particularly in the summer, even more water than is contained in the milk.

Colostrum.—During the first three or four days after the baby's birth the breasts secrete a fluid differing decidedly from true milk; this is the so-called colostrum. It is a distinct lemon yellow, not as sweet as milk, and will coagulate completely upon being heated. It is very rich in proteids and salts, most of the proteid being albumen. Both the fat and sugar are much less than in milk. Its most distinctive differences lies in the presence of the colostrum "corpuscles." These are large granular bodies filled with minute droplets of fat. They have been found to be large leukocytes, though what their purpose and properties are is unknown. Colostrum is secreted in comparatively small amounts. It serves the purpose of a temporary food, and seems to have a decided laxative action, clearing the intestines of meconium.

Quantity.—The daily quantity of milk secreted after the colostrum period is over varies greatly, according to the needs

and the capacity of the infant's stomach. Large, strong babies demand more than small and delicate ones. Also the amount withdrawn at different times in the same day varies remarkably. The following averages are difficult to fix exactly, and are estimated from a large number of experiments in pumping the breasts; in finding the quantity withdrawn by the infant by weighing carefully both before and after nursing; and in estimating the capacity of infants' stomachs, postmortem, at different periods of life.

Daily quantity of milk secreted: During second week, 13 to 18 ounces; during third week, 14 to 24 ounces; during fourth week, 16 to 26 ounces; during second and third months, 20 to 34 ounces; during fourth and fifth months, 24 to 38 ounces; during sixth, seventh and eighth month, 30 to 40 ounces.

Average quantity of each nursing: During first week, 1 ounce; during second week, 1.5 ounces; during third week, 1.7 ounces; during fourth week, 2 ounces; during second month, 2 to 4 ounces; during third month, 3 to 4.5 ounces; during fourth month, 3 to 6 ounces; during fifth month, 4 to 6 ounces; during sixth, seventh and eighth months from 5 to 8 ounces.

Of course the above daily amounts, and the quantity of each nursing vary a great deal, depending on the efficiency of the breast glands, the general condition of the mother, and the size and vigor of the baby. It is also a matter of frequent observation that two infants of much the same size and strength will differ greatly in the amount of milk they require. But, as a general rule, this is regulated properly by nature and needs no interference; nor is any interference of much benefit if it seems indicated.

Rules for Maternal Nursing.— If the mother is able to nurse her child, it should be given the breast regularly, at certain definite intervals, according to the following scheme:

The nursing time should not be more than twenty minutes. The infant usually gets half the total nursing in the first five minutes, three-quarters in the next five; so that in ten minutes most of the milk is obtained. Many babies habitually get enough milk in five or six minutes. If the baby sleeps after

the first few minutes at the breast, it should be awakened and made to complete the nursing.

As soon as nursing is finished the baby should be put back on its own bed and allowed to go to sleep without rocking or other aid. If it is not awake at the next feeding time, it should be awakened. The plan of allowing the infant to sleep as long as it will and nurse when it awakens is recommended by some, and followed by many. Some babies do well on this plan, as they will on any plan of breast feeding, but the best results follow the use of a regular schedule.

The breasts should be nursed alternately, not both at one feeding. This is advisable because completely emptying the breast stimulates the secretion of milk. If both breasts are nursed at a time, they are not completely emptied, the production of milk is hindered, and there is, moreover, a tendency then to revert to the formation of colostrum. Of course, if the supply is insufficient, both breasts should be nursed.

Before and after nursing, the nipples should be cleansed, and after nursing, the baby's mouth should be washed with boric acid solution.

By applying these rules at first, and following them closely, the baby is quickly trained to accustom itself to regularity in eating and sleeping, and the parents are relieved of the greatest trials connected with the care of a baby. In a very short time the child learns to sleep all night and the strain of disturbed sleep on the part of the parents is prevented. This alone is of sufficient value to recommend the plan. Regular nursing is the surest means for good digestion, regular sleeping, comfort on the part of mother and child, and makes the child less liable to attacks of indigestion. It is surprising to see what an automaton a baby can be educated to be; he will learn to awaken almost by the clock, to go to sleep at once after nursing, and to lie quiet and playful when awake. It is important to remember that it is far more difficult to introduce these reforms in the life of a baby who has learned bad habits of feeding than it is to teach them properly to a newborn baby; but it can be done in almost every case, if absolutely insisted upon, no matter what the previous habits.

Feeding Intervals.– As a general rule the interval between feedings should be as long as possible, with the infant quiet, contented, and gaining in weight. Some large, strong babies, getting a plentiful supply of milk, will do perfectly well on a four-hour interval. A great many, probably the majority, will do best on an interval of three hours. Many require food every two and one-half or two hours for the first few weeks. Another general rule that makes for comfort all around, is to allow the child to sleep as long as it will at night. Often after the first month, and generally after the second, a baby will do perfectly well with only one night feeding — after 10 o'clock. Indeed, many at that age require none. For these reasons a schedule of nursing for the various ages is a difficult thing to arrange, and the following simple schedule is to be taken with considerable latitude:

First month: Every three hours, with a total of seven or eight, as the case may be, leaving one interval at night of six hours if there are seven feedings. This can usually be instituted in a very few days.

Second month: Every three hours, with a total of seven feedings, leaving an interval at night of six hours.

Third month: Every three hours, with a total of six feedings; this can usually be accomplished by the end of the third month, and means no night feeding at all.

Fourth month and later: The feedings may remain the same as in the third, but it is often possible to reduce to five feedings at this time. Very often after seven or eight months five feedings are sufficient, and the infant does perfectly well on this allowance. By the tenth month some solid food is usually given in addition to the milk, and five feedings is found to be enough.

A woman's milk as the food, and the above rules in giving it, are the ideals that should be undertaken in the feeding of every infant. But many babies must be brought up on artificial food for various reasons, and the problem then is to furnish a food which is the nearest possible approach to breast milk, and to give this substitute, in accordance with the same rules. The nearer we can copy maternal food in quality, in quantity given, and in regularity of feeding,

the larger the proportion of artificially fed infants that will be kept from gastro-intestinal and nutritional disorders.

Contra-indications for Maternal Nursing.—There are a few justifiable reasons for not giving an infant its mother's milk, even when she has sufficient. Serious chronic disease, such as tuberculosis or nephritis, severe inflammation of the breasts, excessive nervousness, and usually severe acute diseases such as pneumonia and typhoid fever. Cracking of the nipples may be so severe and painful that nursing is impossible; if these cannot be cured by careful treatment, the use of nipple-shield and breast-pump, weaning may be necessary. Sometimes it may be begun again after temporary cessation. Menstruation supervening during lactation frequently causes temporary disturbance; but this is not an indication for weaning, as the milk becomes normal again in a few days. If pregnancy intervene, it is wisest to stop nursing, because the strain on the mother of nourishing herself, the nursing child, and the one *in utero* is too great and should not be undertaken; further, the baby has by this time had the advantage of its mother's milk for some months, and weaning is of less importance to the child than it would have been earlier.

Insufficient Food.—The physician is often asked if he thinks the baby is getting too little food; in fact, crying and restlessness from any cause are usually ascribed to hunger. It is quite important to know the probable signs of this condition, and it is always well to rule out other possible causes before deciding that the symptoms complained of are due to insufficient food. There is no doubt that more children are overfed than fed too little; and the fact that a child will take more food, if offered more, is not sufficient evidence that he needs more for his nutrition.

The main signs of insufficient feeding on which we rely are: lack of the regular weekly gain in weight; fretfulness and crying while nursing, with short, fitful trials of the nipple; and very soft, flabby breasts from which the milk is expressed with difficulty at the nursing time. Less positive, but confirmatory with the above, are: short naps after nursing, instead of sleeping until the next nursing; fretfulness when

awake, with loud screaming as nursing time approaches; irregularity of the bowels, with several small, liquid greenish stools, followed by a day or more of small constipated stools; excessive length of nursing, or only a very short time, leaving the child unsatisfied.

It sometimes happens that a baby is kept on the breast for many weeks when the milk supply has been entirely too small. The child then presents marked evidence of malnutrition, with wasted muscles, flabby skin, sunken fontanelle, anemia, feeble cry, and delayed dentition. It rarely happens that there is lacking any special ingredient in breast milk, but when there is such a lack for any considerable time, it is followed by a special train of symptoms relating to the particular element lacking; this is described elsewhere.

If the symptoms point to insufficient food as the cause of the trouble, the child should be very carefully weighed before and after several nursings, and otherwise try to determine whether the quantity is sufficient and the quality good. It should be remembered that the appearance and texture of the breasts are apt to be very deceptive, as is the difficulty of expressing milk from the nipples. Any change in or addition to the food should be made only after careful observation.

Methods of Analysis.—When the supply of milk is evidently sufficient and the fault probably with one constituent, frequent analyses are necessary to determine the trouble, and to show what success we may have in endeavoring to correct it. An accurate analysis can be made only by a skilled chemist, and this is usually out of the question. And the breast milk varies so much at different times during the nursing, at different times during the day, and on successive days that the results of any single examination are quite misleading. Nevertheless, sometimes valuable information is obtained in this way and the fault corrected or the proper ingredient supplied. The simplest test is that used by Holt, and it gives results close enough for ordinary practice.

Holt's Method.—The necessary articles are a graduated tube with a capacity of 10 c.c., and a small hydrometer, with its cylinder, for taking the specific gravity.

A little more than 10 c.c. of milk is required. First take

the specific gravity in the cylinder. Pour milk into the graduate up to the 10 c.c. mark and let it stand in a nearly uniform temperature of about 70° F.; at the end of this time read the percentage of cream on the graduated tube. The fat is *three-fifths* of this amount.

Having obtained the specific gravity and the fat percentage, and knowing that the sugar is very constant in amount, the proteids can be estimated in the following way; at least, we can ascertain if they are very high or very low: The average specific gravity is 1.031 and the average fat percentage 3.5. A high fat content decreases the specific gravity, and a high proteid content increases it. Thus, if the percentage of fat and the specific gravity are both high, the proteids must be very high; if the fat percentage is high and the specific gravity normal, the proteids are above normal; low fat and high specific gravity indicate normal proteids; low fat and normal specific gravity indicate low proteids; and low fat and low specific gravity indicate very low proteids.

The estimation of the sugar is so rarely indicated that it is negligible; and the amount is nearly always the same.

Diet for Nursing Women.—This should be essentially the same as for any healthy women, not that of an invalid. It should be nutritious, varied, and such as she knows by experience is readily digestible for her; she needs, and will take, more than under ordinary circumstances, but "stuffing" is of doubtful value. Milk is the best single milk-producer and should be taken freely; if anything is to be taken between meals, nothing is better than milk. The use of beer, malt extracts, and other alcoholic liquids is of value only if better appetite results, none of them having any tendency to increase the solids of milk.

Exercise for Nursing Women.—Exercise is necessary for a woman who wishes to properly nourish her baby and, of course, to keep in good condition herself. Walking in the open air combines the advantages of proper exercise, fresh air, and freedom from the cares of household routine. Most women don't lack exercise, but that obtained in household work is best broken into by the daily walk. This is the best

regulator of the quality of the milk, aside from its good effect on the general health.

Drugs in Lactation. Drugs are eliminated through the milk much less frequently than is popularly supposed. Still the milk does at times contain them when taken by the mother, a fact that must be kept in mind when prescribing for a nursing mother; advantage can sometimes be taken of this fact in treating the baby for syphilis, although it is very unreliable.

The more important drugs eliminated in the milk are: atropine (or belladonna) in every case where the full dosage is given; the purgative principles of rhubarb, senna, castor oil, and the saline cathartics often are excreted; less often the heavy metals, mercury, arsenic, iron, etc.; opium, iodides and bromides; volatile oils, as copaiba, garlic, and turpentine.

Antitoxins and various immune bodies are secreted with the milk. It has long been known that young, nursing infants were practically immune to diphtheria and most of the other contagious diseases; this has been shown to be due to immune substances withdrawn by the baby in the milk. The blood of healthy infants, nursing from mothers who have typhoid fever, gives the Widal reaction for typhoid.

Modifying the Breast Milk.— It is wise in all cases of disturbed lactation, where the difficulty can be determined, to resort to certain measures to endeavor to correct the difficulty before making any change in the feeding. Much can sometimes be done by simple measures; when these simple measures fail, others are probably useless.

The quantity can be increased to a certain extent by increasing the amount of fluids taken; milk is the best fluid to take, but it is useless, often harmful, for a woman to take more than a quart a day. Decreasing the quantity is seldom necessary, but can usually be done promptly by decreasing the liquids and the general diet as well.

To increase the total solids stimulation of the appetite, both for liquids and solids, is the rational measure; shortening the intervals between nursings will have some effect.

To reduce the total solids exercise should be increased

decidedly and the diet restricted; lengthening the nursing intervals has some effect.

It is doubtful whether regulation of the diet has any effect on the amount of fat alone, or on the amount of proteid alone. Each is apt to be increased by overfeeding, and each is sure to be too little in a woman who is undernourished. The amount of fat can readily be increased or lowered by changing the amount of food; the proteid can be changed very little in that manner. Exercising to the point of fatigue undoubtedly will reduce the proteids, and will sometimes be of benefit. The commonest cause of excessive proteid is nervousness on the part of the mother, and a reduction will only follow improvement in the nervous condition.

Wet-nursing.—The breast milk of another woman is the best substitute for the mother's milk, and there are infants who will thrive only on woman's milk. The advantages of wet-nursing are manifest, the change being not a substitution and having none of the disadvantages of artificial feeding.

The theory is perfect, but in practice wet-nursing is often far from satisfactory and its difficulties are usually many. The disadvantages are the trouble and expense in getting and keeping a nurse of good character, good habits, and the ability to properly nurse her foster-child.

Good moral qualities and good temper are essential for obvious reasons. Her relations with the family will be so intimate that its peace of mind will be dependent on her. If of bad temper, or free from a sense of responsibility, she may take advantage of the fact that her services are nearly indispensable and leave, or threaten to leave, on the slightest provocation, perhaps at a time when the condition of the baby makes it precarious. If intemperate or dissolute, she may get intoxicated at any time, or may contract some venereal disease, and in this way become distinctly dangerous for the child. In this country the average wet-nurse is the mother of an illegitimate baby, or a married woman in poor circumstances. Neither can be thoroughly depended upon, but any other kind is rarely obtained. No woman with an illegitimate child other than the first should be taken, as

the moral qualities then are apt to be such as to make the woman unfit to nurse a foster-baby. Fortunately, the need for wet-nurses is not so great as it was many years ago, because of the advances made in artificial feeding.

Physical Qualities.—A good wet-nurse should be between twenty and thirty-five years of age, of healthy appearance, and absolutely free from present or past taint of tuberculosis or syphilis. The physician should make a careful examination and go carefully into her history before accepting her. It is advisable to have a Wassermann test made. Nor should it be forgotten that the same assurance should be obtained as to freedom from infection of the baby she is to nurse, and that she runs no risk of being infected. And the appearance of her own baby should be taken into consideration, both as regards her health and the properties of the milk.

The period of lactation during which the nurse is engaged makes little difference, as the milk is practically the same during the entire period. If the foster-baby is only a few days old and the amount of breast milk considerable, it may have to be diluted, or care be taken that the infant does not get too much at one time. It is not advisable to take a nurse toward the latter end of lactation, for the milk may give out at any time and necessitate another change. If the baby has used the wet-nurse for some weeks, its condition may be so much improved that when the milk gives out another nurse may not be necessary.

In difficult cases, where a wet-nurse cannot be obtained, it is advisable, and sometimes imperative, to obtain a small amount of milk from some nursing mother at a distance and have the baby take two or three, or as many as possible, feedings in this way from the bottle.

Deterioration of Wet-nurses' Milk.—Often after obtaining a wet-nurse it is found that her milk soon becomes poor or diminishes, so that she becomes unfit to nurse. This is sometimes due to the marked change in her diet and lack of accustomed exercise; this should be guarded against by making her life as nearly as possible consistent with her former one. If she has not her own baby with her she is likely to be unhappy and discontented, this reacting on the

milk supply. In justice to her and to the foster-child she should be allowed to have the baby with her if it can be arranged, even if it require some sacrifice, in comfort and money on the part of her employers. In wet-nursing, of course, the same rules as to frequency and regularity of feeding should be followed as in maternal nursing.

MIXED FEEDING.

By this is meant a combination of breast and artificial feeding. A baby should be made to take water from a bottle from the beginning, and it is frequently helpful to give one bottle feeding a day if the mother needs the relief from the strain of nursing or the supply of milk is low. This prepares the baby for the use of the bottle in case some emergency arises that demands artificial feeding.

At any time in lactation, particularly in the later stages, it may happen that the mother is unable to furnish sufficient milk for a large, vigorous baby. One or more bottles a day must be used to supplement the breast milk. This is particularly advisable when a wet-nurse is employed, as she is more likely to fail for any one of several reasons, and the infant is not left entirely in the lurch if the bottle has been employed.

In any case it should always be remembered that partial breast and partial artificial feeding are always to be preferred to complete artificial.

WEANING.

Indications.—There are certain indications on the part of both the mother and the child; these have been gone into elsewhere. The regular weekly weighings have a distinct value in this connection, as failure to gain in weight for two or three weeks is a pretty sure indication. If a baby is doing well on the breast, it is well not to wean in the summer even though the baby is a year old. As a general rule it is advisable to have a baby weaned by the age of ten or twelve months. They rarely thrive on the breast more than a year;

anemia develops because of the lack of iron in the breast milk, and that which is stored in the child's liver at birth is used up by the tenth or twelfth month. And by this time there are usually enough teeth to permit eating other food, and the teeth are likely to make nursing very uncomfortable for the mother.

Methods.— If begun toward the end of lactation, and for ordinary reasons, weaning had best be done gradually by the substitution of other food once or twice a day; very soon the breast milk can be eliminated entirely. It is here that the value of having previously accustomed the child to the use of the bottle is demonstrated. Usually the process is readily accomplished, but occasionally a baby will absolutely refuse to take anything but the breast. In these cases it is necessary to have someone other than the mother give the feedings, as the baby naturally expects something beside a bottle from its mother. If the child will not take the milk at one feeding, it must wait until the next period; and sometimes it must be starved for twenty-four hours or more, no alterative being available. Gavage has to be resorted to rarely to keep the child from starvation.

COWS' MILK.

Practically the only substitute for permanent artificial feeding of infants is cows' milk, so modified as to make it resemble human milk as nearly as possible. The proximate principles in the two varieties of milk are the same, but the proportions differ very decidedly. There is also a decided difference in the properties of the casein in the different milks, that in human milk being more flocculent and less readily curdled and hence more easily acted on by the infant's digestive fluids. But for the purposes of proper nourishment this and other minor chemical differences have to be ignored.

Chemical Composition.—Fresh cows' milk has an amphoteric reaction, more acid than alkaline, but the reaction becomes positively acid on standing in the air. The specific gravity varies from 1.028 to 1.033. The average composition of

ordinary herd milk is as follows: Proteid, 3.5 per cent., of which about three-fourths is casein; fat, 4 per cent.; sugar, 4.5 per cent.; salts, 0.7 per cent. That from different breeds varies greatly, that of Jersey and Guernsey cows being very rich in fat but not so suitable for infant feeding as the Holstein, Ayrshire, and other "poorer" milk which contains less fat but more proteid and sugar.

Comparison of Cows' and Human Milk.—The two tables of components should be compared and firmly fixed in the mind, particularly the great difference in proteid, sugar, and salts; and remember that all the food elements are in larger proportion in cows' milk except the sugar.

Proteids.—The proteids differ from those of woman's milk not only in quantity but in the relative proportions of casein and lactalbumin, the casein being three times the lactalbumin, instead of about the same. It differs also in being much more readily and firmly coagulated, and consequently less readily digested than the fine, flocculent precipitate of human casein. Notwithstanding this difference, cows' milk is usually readily digested by infants as far as the proteid is concerned. When the casein is precipitated (by rennin, acid, etc.), the resulting straw-colored liquid (whey) contains the soluble lactalbumin in the proportion of about 1 per cent.

Fat.—This needs no special comment, being the same practically as in human milk. The droplets are much smaller than those of human milk but this fact has no practical importance.

Sugar.—This is present as lactose, the same as in human milk; being in smaller proportion, the milk is much less sweet than human milk and, what is of more importance, of less nutritive value. It is not as sweet as cane-sugar, and milk with the requisite amount of cane-sugar has a decidedly sweeter taste than if milk-sugar is used; so the infant's objection to cows' milk, on this score, is readily overcome.

Salts.—These are three and one-half times as abundant as in human milk, with a marked excess of calcium phosphate. They are of much more importance in digestive disturbances than was suspected until recently, and must sometimes be lowered by careful modification.

Bacteria. Cows' milk is collected in such a way that it always contains bacteria, and in this it differs in a vastly important way from milk nursed from the breast. According to the care and cleanliness exercised in the milking and handling, it contains from 5000 to 1,000,000 to the cubic centimeter by the time it is used. Many of the bacteria are not harmful to the infant and cause no harmful change in the milk. Others do cause disease, and many cause such changes in the milk as to make it unfit for consumption.

The commonest ones are those that produce acid by their action and thus cause the milk to sour and curdle. They are not harmful otherwise; in fact, they may be of value in prohibiting the growth of harmful organisms that cannot grow in an acid medium. Of these the commonest are the ones that form lactic acid, generally the Bacillus lactis acidi.

The most common disease-producing organism is the colon bacillus, which is a contamination from the manure; it also causes the souring of milk. The most important one is the tubercle bacillus, and the one which should be most guarded against; this can only be done by seeing that the cows from which the milk comes are not tuberculous. Others are the typhoid bacillus, diphtheria bacillus, streptococcus, and the scarlet-fever organism; they are only present through carelessness on the part of the producer.

Sources.—Contrary to the general idea, milk from a herd is usually preferable to that from only one cow, as one cow's milk is more apt to vary in its proportions from time to time than that from a herd. Further, if this cow is diseased, the infant is more exposed to infection than if the milk of one diseased cow is diluted with that from an entire herd; of course the converse must be considered—that one of several cows is more likely to be diseased than an individual.

Tuberculosis is a very common disease in cattle and should be particularly guarded against. All herds used for dairy purposes should be tested at frequent intervals for tuberculosis, and the infected animals isolated or killed; no new cows should be added to a herd until they have been proved free from the disease.

Milking and Marketing.—For detailed description of proper methods it is best to refer to the standards set by the American Association of Pure Milk Commissions. These commissions have been responsible for an almost unbelievable improvement in the quality of milk put on the market in many large cities and known as certified milk. Here it is enough to say that milking should be done with clean hands; the teats and adjacent parts of the animal made scrupulously clean; all receptacles for the milk should be sterile and protected as much as possible by clean coverings; and it should be cooled to 45° F. immediately after milking, and kept so. Needless to say, the sooner it is used after milking the safer it is.

Sterilization.—Even with the greatest cleanliness and every precaution possible, cows' milk always contains from 2000 to 5000 bacteria by the time it is used. For this reason processes of sterilization and pasteurization have been employed, to destroy or diminish the bacteria. Sterilization is effected by heating the milk to 212° F., either by boiling or by the exposure to the action of steam or boiling water. It is usually kept at this temperature for twenty minutes. This accomplishes the destruction of the ordinary germs that cause the diarrheal diseases, as well as the germs of tuberculosis, diphtheria, typhoid fever, in fact practically all the pathogenic organisms. Such milk keeps well and is perfectly safe as far as any infectious disease is concerned; but certain undesirable changes take place in the milk in this process; the taste of sterilized milk is different, and is not as agreeable as that of raw milk; the sugar is partly turned to caramel and may give the milk a brownish appearance; the casein is less readily coagulated and the lactalbumin nearly all precipitated; the fat droplets are broken up and the rising of the cream very materially delayed. Children fed on this milk are more apt to be constipated; also there is a good deal of evidence that its prolonged use induces scurvy in the infant; this is a much-debated question and certainly not definitely proved.

Methods.—Milk may be sterilized by boiling, by putting the vessel containing it in water and boiling the water the

required time, or by subjecting the vessel to the heat of steam in a closed chamber built for that purpose. The Arnold steam sterilizer is a small, practical apparatus for accomplishing this by the circulation of steam in a confined chamber around the bottles containing the milk. Milk is best sterilized in the bottles it is to be fed from.

Pasteurization.—Since the profession has appreciated that the sterilization of milk has its drawbacks, efforts have been made to find a method of destroying the bacteria without producing these objectionable changes in the milk itself. A method now much used for this purpose is *pasteurizing*, and is based on the idea of using the least amount of heat that will destroy the ordinary bacteria that are known to be injurious. This amount of heat has been found to be 167° F., or, practically, it is found that a temperature of 145° F. for thirty minutes does perfectly well. It should then be immediately cooled and kept so. Such milk is free from harmful bacteria, and presents none of the changes in taste and other properties that sterilized milk does. It is the preferable treatment, but manifestly less easy to employ.

Methods.—Pasteurization is easily accomplished by means of Freeman's pasteurizer; this will contain enough boiling water to bring up to a temperature of 167° F. a certain number of bottles of milk, and retain them at about this temperature for twenty minutes. The process can be carried out by filling a large pan with enough water to reach the level of the milk in the bottles, heating to a temperature of about 145° F., then covering with heavy cloth and allowing to stand for thirty minutes. Then the milk should be *at once* cooled, best in running water, and kept on ice.

Either pasteurization or sterilization is necessary for young infants during the summer, except with the cleanest of milk, and they are often valuable measures even in cool weather. It is always best to be on the safe side; remember that they are best used as preventatives of digestive disorders, not to cure them after they have started.

ARTIFICIAL FEEDING.

We have seen that cows' milk contains the same proximate principles as woman's milk, but in different proportions. The problem of preparing cows' milk for use as an infant food consists in so changing these proportions by addition and subtraction as to make a milk in which the food constituents are virtually the same as in human milk. Knowing the average percentage of the constituents of human milk and the exact analysis of the cows' milk we are to modify, it is comparatively easy to prepare a food such as is proper for the average child. In certain individual cases the digestive power of the child may require some far different proportions than the average child needs. Such changes in the infrequent cases, although a little more difficult to figure out, can always be managed by intelligent modification of the milk.

In order to simplify a comparison of the differences between the two varieties of milk, and show concisely what changes must be made, the following table will be of assistance:

Woman's Milk:

Sterile, not contaminated.
Proper temperature.
Adapted to capacity of infant's stomach.
Alkaline reaction.
Constitutents readily digestible.
Proteid, 1.5 per cent.
Fat, 3 per cent.
Sugar, 7 per cent.
Salts, 0.2 per cent.

Cows' Milk:

Contains bacteria, which increase with age of milk.
Must be warmed.
Amount must be carefully regulated.
Acid reaction.
Constituents less readily digested.
Proteid, 3.5 per cent.
Fat, 4 per cent.
Sugar, 4.5 per cent.
Salts, 0.7 per cent.

Methods of Examination.—Most important in the use of milk for infant feeding is the source of the milk used. This has been mentioned elsewhere, but it will bear repeating; the physician should assure himself that the milk has been obtained in a clean manner, kept cold since milking, and as free as possible from any subsequent contamination. There are methods, however, for ascertaining the food value of the milk which should always be employed if any suspicion exist as to its quality. The reaction and the specific gravity should be taken and the amount of fat calculated.

The first two offer no difficulty. For the estimation of the fat, the quickest and most dependable test is by means of the Babcock centrifugal machine. In this a measured quantity of milk is mixed with sulphuric acid and then revolved rapidly in the machine; after five minutes the entire amount of fat has come to the top and the percentage read off on the graduated scale. There is no practical method for the determination of the percentage of proteids; this can only be done by a skilled chemist. The relation of fat to specific gravity, as described under Human Milk, offers a means of some value, but it is far from being accurate.

The sugar content is so nearly uniform that it can always be figured at 4.5 per cent.

As a precaution it may be stated that milk which curdles when boiled should never be used, as this means it is too near the point of souring. And milk which has an alkaline reaction has had some chemical added to it which changed the reaction, and it should be rejected.

Modification of Cows' Milk.—This means nothing more nor less than changing the milk to suit the digestion of the infant. The simple dilution of milk with water, without the addition of anything at all, is a modification of the milk. Various schemes of modification have been advanced to simplify the routine prescribing of milk for babies, and these will be gone into in some detail.

Proteids.—The belief in the difficulty of digestion of this part of cows' milk was the basis of milk modification until quite recently. It is now generally conceded that much

of the trouble thought to be due to casein is really due to something else. The fat and sugar certainly can and do cause perfectly definite, well-recognized types of illness, and if given in too great quantity are almost sure to cause trouble. The cases of difficult digestion of proteid are not so clearly defined, but there is certainly a decided difficulty in digesting casein manifested by some children, both artificially and breast fed. Casein can often be taken in much greater quantities than are present in human milk without causing any disturbance. Even when it appears undigested in the stools, in the form of curds, it is often an evidence only of lack of digestion rather than indigestion, and as such needs no attention. The Eiweissmilch of Finkelstein and Meyer contains 3 per cent. of proteid, with only 2.5 per cent. of fat; and it is used as a diet for sick infants whose digestive ability is below par. The ease with which it is digested shows the practical harmlessness of casein in the infant's diet. Many infants digest undiluted cows' milk perfectly well at the age of six months.

During the early weeks of life it is best to use only about 1 per cent. of proteid. This can be rapidly increased as the tolerance to it is demonstrated. A baby should never be kept for many weeks on a food low in proteid, as malnutrition of some sort is sure to develop.

Fat.—There is now no question that the fat in the milk is responsible for a great deal of digestive trouble in infants.

This view has been brought forward prominently by Czerny and Keller, who ascribe the chief role of trouble-making to the fat. It is certain that decided digestive disorders may be very readily caused by too much fat in the food; also that both digestive and nutritive disorders may be caused by too little. It is therefore of the utmost importance to pay particular attention to it in beginning to feed a baby artificially. Here also it is best to begin with a small percentage of about one, for a very young baby. Probably no infant can properly digest more than 4 per cent. of fat in cows' milk for any length of time. More than that is not needed and should not be given. Beginning with 1 per

cent., the amount can be increased gradually until the infant's need is supplied; this usually means from 3 to 3.5 per cent. It is important to remember that the fat of cows' milk, or the cream, contains very many more bacteria than the mixed milk, for they rise with the cream and remain in it; for this reason more care should be exercised in inquiring as to its freshness, and in keeping it properly. Cream must often be added to milk mixtures to get the required quantity of fat.

Sugar.—Milk-sugar, or any other sugar used in infant feeding, may be responsible for serious digestive disturbances. Finkelstein and Meyer strongly represent the difficulties of sugar digestion, and have advised the use of a mixture of dextrin and maltose in all such conditions. This sugar certainly has many advantages in the feeding of certain digestive disorders; its value in healthy babies is questionable. But it is also doubtful whether milk-sugar has any special value in artificial feeding of healthy infants. Cane-sugar or maltose are practically always just as well borne; if any sugar gives trouble, the solution usually lies in decreasing rather than changing. It is best never to use more than 7 per cent. It should be remembered that cane-sugar is sweeter than milk-sugar, and slightly smaller amounts are needed.

Salts.—In making up formulæ for the feeding of healthy infants the salts never enter into consideration. Certain conditions demand the extraction of the greater amount of the salts in cows' milk, and this will be considered in that connection.

Diluents.—The usual diluent for weakening the milk is, of course, boiled water. It has been found that the use of thin cereal gruel, usually of barley or oats, renders the casein more flocculent, or in some way facilitates its digestion for many babies. They are used advantageously in cases where some slight aid is needed, and the amount of starch they contain is readily digested by very young infants. The gruel of barley has a slight tendency toward constipating the infant, and that of oats has slightly the reverse tendency. Flour prepared from both is marketed conveniently in

cans, and the process of making the gruel is much shortened by their use; prolonged boiling is necessary when the whole barley or the rolled oats are used. As a simple diluent it suffices to use two teaspoonfuls of either to a pint of water, making up to a pint the water that has evaporated in the boiling. Rice water or that made with wheat or arrowroot flour usually answers as well.

Bottles, etc.—It is best to make up at one time the total amount of milk required for the day's feeding. This may be kept in a large jar in the ice-box and the proper amount measured out for each feeding. Decidedly the preferable way is to separate it into the requisite number of bottles, stoppering each with a piece of sterile cotton. Pasteurization or sterilization may be carried out with either plan, after the milk has been prepared. When the milk is removed from the ice, it should be warmed to about 98° F. before being given to the baby.

Bottles and nipples should be of the simplest character in order that they may be easily cleaned. The graduated bottles are very convenient, but one must be sure the graduations really represent what they are marked. The best nipples are those that can be turned inside out for cleaning; the so-called "anti-colic" nipples are really nothing of the sort—that variety does not exist. It should be a matter of routine to turn the bottle upside down after the nipple has been applied, and see that the milk flows in rapid drops; it should not run in a stream, nor should it drip very slowly. The latter defect can be remedied by using the red hot end of a medium-sized needle to make a small hole.

Both bottles and nipples should be cleaned at once after use, as it is much easier then than after they have dried. The nipples may be kept in a solution of boric acid when not in use. Before the bottles are used the next time they should always be boiled or scalded.

Rules for Feeding.—The artificially fed baby should be given food in certain definite quantities at regular, stated intervals. As has been mentioned before, the amount and the interval vary greatly with babies of the same age and the same size, so that no definite rules can be laid down.

The following scheme is only to represent the average, and can usually be closely followed:

	Interval hours.	Number.	Ounces.	Total.
First month	3	7 or 8	2 to 3	14 to 24
Second to fourth month	3	7	3 to 5	21 to 35
Fifth to seventh month	3 or 4	6 or 5	5 to 8	30 to 40
Later	4	5	8 or more	40 or more

As was stated under Breast Feeding, it is usually possible to begin with the three-hour interval and continue it; some babies comfortably manage on a four-hour interval. But the above will be found to suit the conditions as a general rule.

The time allowed the infant to empty the bottle should not exceed twenty minutes. Most babies will finish in much less time than this. It is sometimes necessary to waken the baby several times, as it will fall asleep when the acute pangs of hunger are satisfied. If the child falls asleep and remains so for some little time without having finished the bottle, do not warm the milk over again and give it when the child awakens; wait until the next regular interval and give the full amount at that time. A simple and valuable expedient for keeping the milk warm, if the child takes fifteen to twenty minutes to finish nursing, is to fit a flannel sack over the bottle, tied firmly around the neck; this is especially valuable if the feeding takes place in a cold room or out of doors. The milk should always be shaken before feeding to distribute the cream evenly throughout.

Increase in Diet.—By the tenth month it is best to begin using some other food with the milk. There is a very great difference in children as to the variety, the amount, and the age at which it is best to begin. Some form of cereal, as thick barley or oat gruel, cream of wheat, or any of the starches, is the most important item. This may be given in the milk or fed with a spoon after being covered with milk or cream; it should not be sweetened. Broths of beef, lamb or mutton may be given, and, if the child has sufficient teeth, a small crust of bread or cracker. Orange juice or the juice of cooked prunes comprise the best means for giving the acids contained in fruits; their value as laxatives is manifest in some cases, in others no such action is seen.

The best plan with these foods is to try to have them take the place of part of the milk at one or more feedings. If this is not done, the number of feedings is increased and before long the feeding schedule is found to be entirely disarranged. The fruit is best given in the morning, beginning with a scant teaspoonful and increasing to an ounce or more. The others are best given at noon and evening. It is a good rule to remember that any new food given to a baby should be given in very small amounts at first to make sure it is going to cause no trouble.

Milk Laboratories.—For about twenty years there has been an increasing number of so-called milk laboratories in the larger cities of the United States. They are all branches or imitations of the original Walker-Gordon laboratory in Boston, begun under the supervision of Rotch. At these places the milk is ordered by prescription as medicine would be ordered at a drug store. The milk is obtained from carefully kept and tested cows and shipped to the laboratories with proper precautions of cleanliness and temperature. The bases for the preparation of formulæ are a 32 per cent. centrifugal cream, fat-free (skimmed) milk, and a 20 per cent. solution of milk-sugar. With these any desired percentage of proteid, fat and sugar can be easily obtained for feeding.

Special Mixtures.—Whey is used to obtain a food with a greater proportion of lactalbumin and less casein. Gruels of barley, oats or wheat are used as diluents when requested. Lime water is used to produce the desired alkalinity.

The physician in ordering the milk knows the requirements of his particular case and, on a prescription-blank prepared for the purpose, writes the order for the modified milk.

Form of Prescription Blank:

℞—Proteid . . . . . — per cent.
(*a*) Casein . . . . . — "
(*b*) Lactalbumin . . . . . — "
Fat . . . . . — "
Sugar . . . . . — "
Alkalinity . . . . . — "
Number of feedings . . . . . —
Amount of each feeding . . . . . —
Heat to_____for_____minutes.

The physician may simply write out on his own blank the percentages of food, alkalinity, number and amount of feedings, and send it in to the laboratory. A basket with the required number of bottles for twenty-four hours is delivered at the house each day, the formula being changed from time to time by the physician with new prescriptions.

Advantages. Food prescribed through the medium of these laboratories has the advantage of accuracy of percentage of the constituents, exact quantity of milk, carefully handled milk, and ease of changing percentages gradually and exactly as the need arises. Further, it is very difficult for the members of the family to make any change, through error or design, in the quantity or strength of the milk. In fact, it is occasionally almost necessary to have access to some such place, because of the ignorance, carelessness or neglect of the baby's caretaker.

A decided disadvantage is the considerable expense, which puts it out of the reach of the people who need its benefits most.

Home Modification. This is the necessary procedure in the great majority of cases; and it is, in fact, usually the most satisfactory. Modification at home is troublesome, particularly in the beginning, but it requires only moderate intelligence to prepare the milk according to the physician's directions, and if the proper care and cleanliness are exercised, it is perfectly safe and becomes much less troublesome after the steps are systematized. Exact percentages cannot, of course, be obtained, but this is a matter of slight importance except in the few difficult cases; even then, by special care, exactitude can be approached closely, though the physician must figure it out without the aid of any prepared scheme. The physician who earnestly tries to master the details of artificial feeding will find it rarely necessary to depend on laboratory milk. The various methods of modifying cows' milk cannot all be gone into thoroughly in a work of this kind. The most simple and practical will be explained in detail; but one must bear in mind that some authorities use and recommend methods quite different from those recommended here; and apparently the results obtained in the different ways differ scarcely at all.

Simple Dilution of Whole Milk.[1]—This is manifestly the simplest of all methods. More than that, it is perfectly satisfactory in the majority of healthy babies, and is coming gradually into greater favor all the time. The apparent objection to it lies in the comparatively large percentage of proteid necessarily obtained when the fat is of the requisite amount; for instance, if it is desired to give milk containing 2 per cent. of fat, one must use equal parts of milk and water, as the whole milk contains 4 per cent. As the milk contains 3.5 per cent. proteids, this of course results in a proteid percentage of 1.75; this is less fat and more proteid than the average human milk. When the fat is increased to 3 per cent., the proteid becomes 2.6 per cent., or considerably more than that of human milk. But it is certain that an excess of proteid does no harm and is rarely the cause of digestive disorders if the excess is reached gradually by slowly increasing the amount of milk in the mixture, at the same time being sure that the amount of fat is sufficient. Of course the dilution of whole milk in this manner reduces the sugar to a very small percentage; the deficiency must be made up by the addition of some kind of sugar, and can be kept constantly at 7 per cent., when it is evident that the child can digest it properly. Ordinary granulated sugar usually agrees with the baby perfectly well, is readily obtained pure, certainly is the least expensive, and has the distinct advantage of being sweeter, which makes the milk palatable with the use of small amounts. Unless there seems to be some reason for doing otherwise, the use of granulated sugar may be made a matter of regular routine. If there is evidence that the sugar in the mixture is causing some slight difficulty and a moderate decrease in the amount is not productive of results, it is best to use one of the dextrin-maltose preparations, preferably Mead's Dextri-maltose. With this a tolerance to sugar can be induced and the granulated sugar begun again in a few weeks, gradually replacing the maltose.

In beginning to feed artificially a baby of any age, and

[1] Practically all the feeding of normal babies in the St. Louis Children's Hospital and the out-patient department of Washington University, St. Louis, is done by simple dilution of whole milk.

particularly a very young baby, it is necessary to start in with a mixture very low in proteid and fat, and rather low in sugar. The strength may be increased from day to day so that there is little danger of weakening the child by starvation. In this connection it is well to reiterate that a baby should not be kept on insufficient breast feeding long enough to become too weak to stand a moderate artificial mixture.

The amount of fat to be aimed at for the baby's regular diet is 3 per cent. Most babies can digest this amount readily at three months, when artificially fed, but it is not at all necessary to arrive at this percentage before five or six months. This means that the milk should by this time be diluted only one-fourth. Increasing the strength from this time on is a question of individual need entirely. Often babies will continue to do well on this dilution up to eight or nine months; but it is usually easy to increase still further at any time after six months, and this can be done when indicated.

It is evident that the percentage of proteid must be practically disregarded in figuring whole milk mixtures, as the fat must be given in sufficient amount and this necessitates an abundance of proteid. The fat, therefore, is taken as the basis in simple dilution.

Taking the fat content as 4 per cent., it is evident that if we wish a 1 per cent. mixture it must contain one-quarter milk; a 1.33 per cent. mixture must contain one-third milk; 2 per cent., one-half milk; and 3 per cent., three-quarters milk. It is surprising how many babies can be satisfactorily fed by judicious use of these proportions. If other percentages are required, they may be obtained in the following manner:

Suppose a mixture containing 1.5 per cent. of fat is desired with a total twenty-four-hour amount of 24 ounces. As the amount of fat in whole milk is 4 per cent., $1\frac{5}{4}$ (one and one-half fourths), or $\frac{3}{8}$ of the total amount, will have to be milk; $\frac{3}{8}$ of 24 is 9, which is the amount of milk the mixture must contain. Again, if a mixture of 2.2 per cent. fat is desired, with seven feedings of 5 ounces each, a total

of 35 ounces; $\frac{2}{4}\frac{2}{4}$, or $\frac{1}{2}\frac{1}{0}$ of the mixture must be milk; $\frac{1}{2}\frac{1}{0}$ of 35 is 19.2, which is the proper amount of milk to use.

The above mixtures, of course, contain far too little sugar for the infant's needs, and more must be added. Taking the last formula as an example, it is seen there are 19 ounces of milk in a total of 35. The percentage of sugar in the whole milk is 4.5; therefore the diluted mixture contains $\frac{1}{3}\frac{9}{5}$ of 4.5 per cent., or 2.5 per cent. This to be increased to 7 per cent. by the addition of sugar, and 2.5 from 7 leaves 4.5, the percentage of sugar to be added. 4.5 per cent. of 35 ounces is 1.7 ounces. A rounded tablespoonful of sugar represents one-half of an ounce; 1.7 multiplied by 2 then will represent the number of tablespoonfuls of sugar that must be added to the milk, or, roughly, $3\frac{1}{2}$. This method is sufficiently accurate for all practical purposes.

Lime water is added to make 5 per cent. of the mixture; this, of course, replacing part of the water used for dilution.

Practical application of this manner of artificial feeding may be carried out in the following manner: The first day after birth the baby needs no food but water; the second day it should be given $1\frac{1}{2}$ ounces of one-fourth milk every three or four hours. If this is evidently not sufficient, the second day give 2 ounces, the next $2\frac{1}{2}$; do not make the mistake of sticking to a rule and hesitate to give a newborn baby 2 or $2\frac{1}{2}$ ounces at a feeding if it is evidently hungry. The strength of the milk may be increased gradually so that by the end of the second week the child can take one-half milk. And remember that if a child does well on a four-hour interval, *do not change it;* if it does well on a three-hour interval, do not change that. It may never be necessary to give the food at any shorter intervals.

In beginning this feeding with babies who are older, and who have been previously fed some other way, it is well to begin with a one-third mixture and in amounts suitable to the age. The strength can be increased daily until it is evidently enough.

The determination of the actual needs of the infant in caloric value of its food will be taken up later.

Percentage Feeding.—By this is meant a method for securing fairly accurate percentages of all the constituents of the milk. The means of obtaining this result are various and differ only in the strength of the various top-milks employed. None has any advantage over the others in results, and each is used on account of the ease and simplicity it affords to those who are familiar with it. Each pediatrist is familiar with whatever method he employs; the others all seem cumbrous. For the use of the average physician the one is presented here which seems easiest to understand, most convenient for home use, and lends itself most readily to changes necessitated by lack of proper utensils, facilities, etc., in the home.

Advantages.—In theory it is of great advantage to approximate as closely as possible the percentages of ingredients that are present in human milk. There are many cases, especially among young infants, where this advantage is very evident. In these the use of percentage feeding is very helpful. It is usually easier to tell what particular item in the food is causing some trouble, and often easier to correct it. On the whole, it is perhaps more successful in infants who are a little below par in strength and vigor and whose digestive powers not quite what they should be in a normal, healthy infant. Another undoubted advantage, among more intelligent people, is that it appeals to the parents as a sensible effort to provide the best possible food for the baby. The cream portion looks rich and palatable.

Top-milk.—The method recommended is one requiring the use of "top-milk." This is a name applied indiscriminately to the upper portion of milk on which the cream has risen. Of course it will contain various amounts of fat, according to how long it has stood, how much of the upper portion is removed, and how rich in fat the milk is in the first place. For ordinary purposes it is well enough to assume that milk which has stood in the bottle for six hours contains, in the *upper half* 7 per cent. fat; this means that if the upper half is carefully drawn off and then shaken it represents a value of 7 per cent. fat. Of course, the less is taken from the top the greater is the percentage of fat. In a quart bottle the

amounts are as follows, assuming that the milk contained 4 per cent.:

Amount			Fat, per cent.
Top 2	ounces	contain	24.0
4	"	"	21.4
6	"	"	16.8
8	"	"	13.3
10	"	"	10.5
12	"	"	9.0
14	"	"	7.8
16	"	"	7.0

Of course, the percentage decreases as still more milk is taken off, but that in the upper 16 ounces is of the greater importance. Gravity cream, or that part of the cream which is visible as a sharply marked layer on top, contains 16 per cent. fat. Skimmed milk contains about 1 per cent. Separated (centrifugalized) milk contains no fat.

All these proportions may be considered as having 3.5 per cent. proteid and 4.5 per cent. sugar; there is some difference, of course, in the different strengths, but this is so small as to be negligible in practice.

With a knowledge of these proportions it is possible to figure out a formula for an infant without resorting to any special system; but it is a matter of great convenience, and makes one more confident, to have in mind some regular plan for the feeding formula. The 7 per cent. milk (the top half) readily lends itself to modification in a way that makes it easy for the mother to prepare.

The particular "top-milk" used in this method is that represented by the sharply marked cream layer, the so-called "gravity cream." This is usually about 6 or 7 ounces to a quart of milk, or 3 or $3\frac{1}{2}$ to a pint. Its sole advantage over a number of others lies in its simplicity and convenience, particularly to the person who has to prepare the food.

The basis of this method consists of gravity (16 per cent.) cream, skimmed milk, and bulk sugar, granulated or milk-sugar. It is essential to remove the cream carefully in order that none of the underlying milk is mixed with it; to do this it is best to siphon it off, or to use one of the small dippers made for that purpose called Chapin dippers. In using the

skimmed milk it is best to take that from near the bottom of the bottle, as that contains a smaller proportion of fat than any other. Pouring the cream from the bottle cannot be done without permitting so much milk to come with it that the results are extremely inaccurate; it should not be done. When only a small quantity of milk is needed for the twenty-four-hour feeding, as for a very little baby, enough cream can be obtained from a pint bottle of milk; if a large quantity, as 48 ounces with 3.5 per cent. fat, a pint and a quart, or even two quarts, will have to be used. Whatever milk or cream remains from the preparation of the food can, of course, be used by the family for other purposes and need not be wasted; but such an amount as two quarts of milk a day may make a serious inroad on the family finances and this must be taken into consideration in the feeding of the baby.

With the top-milk, skimmed milk, and sugar it is possible to make any desired percentage mixture, using water or thin cereal gruels to dilute. The procedure is exactly the same as with whole-milk dilutions; but percentage figures must be used in every case, whereas with the whole milk it is often possible to dispense with this.

The proteid content of the cream and milk is assumed for convenience to be 3.5 per cent., the sugar 4.5 per cent., and the fat 16 per cent. It is desired to prepare a mixture containing 3 per cent. fat, 1.5 per cent. proteid, and 7 per cent. sugar; seven feedings of $3\frac{1}{2}$ ounces—a total of 25 ounces. As the fat desired is 3 per cent. and that in the cream is 16 per cent., it is evident that $\frac{3}{16}$ of the mixture must be made up of cream; for instance, if 8 per cent. of fat were required, the mixture would be made up of one-half gravity cream, or $\frac{8}{16}$; only 3 per cent. is required, and the proportion is $\frac{3}{16}$. $\frac{3}{16}$ of 25 ounces is 4.7 ounces, the amount to be used.

It is desired to have 1.5 per cent. proteid in the mixture. The cream contains only 3.5 per cent., and in 4.7 ounces diluted to 25 ounces there would only be $\frac{4.7}{25}$ of 3.5 per cent. or 0.66 per cent. As 1.5 per cent. is desired, this leaves 0.84 to be added by means of the skimmed milk. $\frac{84}{3.5}$ of 25 is 6.

by the same process as we took to ascertain the amount of cream, and this amount of skimmed milk must be used.

In the 4.7 ounces of cream and the 6 ounces of skimmed milk there is 4.5 per cent. sugar; this makes 10.7 ounces. When diluted to 25 ounces this would reduce the sugar percentage to $\frac{10.7}{25}$ of 4.5, or 1.9 per cent., or 2 per cent. practically. This leaves 5 per cent. to be added, to make 7 per cent. Five per cent. of 25 ounces is 1.2 ounces; as in the whole milk dilution we assumed that one rounded tablespoonful of sugar equals $\frac{1}{2}$ ounce, here also we can multiply by two and we have the number of tablespoonfuls; 1.2 times 2 is 2.4, and we add that amount for the sugar percentage of 7.

Lime water is added to make 5 per cent. of the mixture, which would mean 1.2 ounces in 25.

The completed formula then would read:

Gravity cream	4.7 ounces
Skimmed milk	6.0 ounces
Granulated sugar (or other)	2.5 tablespoonfuls
Lime water	1.2 ounces
Water, enough to make	25.0 ounces

As one has this method presented to him for the first time it may seem as though he would be deeply involved in figures, but as the operation is a similar mathematical one for each constituent, it is really very simple when it has been tried a few times.

In regard to the use of lime water, it may be stated that many babies do perfectly well when it is not used at all in their milk. It has no value as food because there is a superabundance of lime salts in the milk without it. Its only service is to decrease the acidity of the cows' milk and aid slightly in rendering the milk more readily digestible.

It is generally well to provide enough in the twenty-four-hour mixture to allow for a broken bottle, or one that has been overturned. And it is usually best to try to make a number of ounces that is easy to figure with, if adding another ounce or two will do it, as 30 ounces if the amount needed is 29.

Caloric Values in Feeding. — Fat, proteid and sugar, and every other food, have a certain definite value per gram in

the production of heat and energy when used by the body as food. This value has been ascertained and systematized and the needs of the body definitely established, so that it is possible to say what amount of fat, of sugar, and of proteid is absolutely necessary for a baby of a certain weight. The unit of heat production is the calorie, and feeding by calorie means figuring the amount of calories each particular child must have and dividing the proportion properly among fat, sugar, and proteid. Or, as is usually done, preparing the milk mixture for the baby and then, if the gain is not sufficient, figuring the caloric value to see if the need is satisfied, according to the weight. The infant needs about 100 calories per kilogram (2.2 pounds) of body weight up to the age of six months; after that the proportion slowly decreases so that the requirement at the end of the first year is 80 calories per kilogram. Very active infants, and those who have been underfed for some time, need greater proportions, often 130 or 140 calories. The important point is to be sure not to have too little, rather than be afraid of giving too much.

The principal value of fat and sugar (which includes all starches) consists in their production of heat and energy. The proteid is the most essential for the reason that it is the nitrogeneous food and is needed for the growth and development of the body, as well as having the heat and energy value. It is well to remember that the growing baby needs 2 grams of proteid to every 1000 grams of body weight every twenty-four hours. This is sufficient to maintain the nitrogen balance (equalize the intake and the excretion of nitrogen) and also furnish the excess needful for growth.

The caloric values of the foods are as follows:

1 gram of fat furnishes	9.3 calories
1 gram of proteid furnishes	4.1 "
1 gram of sugar or starch furnishes	4.1 "

A distinct value in the practice of feeding by diluting whole milk lies in the ease of figuring the caloric value of the food mixture. The approximate number of calories in one ounce of ordinary milk containing 4 per cent. fat is 20; and it is well for one to figure it out for himself, not only to be certain of it, but for the value of the practice,

It is necessary to figure the calories in the metric system, and the following equivalents are therefore needed:

1 ounce is equal to (approximately) . . .	30 gms., or 30 c.c.
1 pound is equal to (approximately) . . . (or 1 kilogram equals 2.2 pounds)	$\frac{5}{11}$ kilogram
1 pound is equal to	450 grams

The process where dilutions of whole milk are used is quite simple. In feeding a baby six months old, weighing 14 pounds, we are giving six feedings of 7 ounces each, and using a mixture of 22 ounces of milk and 20 of water; as this contains only 2.3 per cent. sugar, we have added 4.7 per cent. of 42 ounces, or 2 ounces. We have therefore to find the number of calories contained in 22 ounces of whole milk and 2 ounces of sugar; then find how many calories the baby is getting to each kilogram of weight. Each ounce of whole milk contains 20 calories; 22 times 20 is 440. Two ounces of sugar equals 2 times 30 grams, or 60 grams. Each gram of sugar contains 4.1 calories; 60 grams contain 60 times 4.1, or 246 calories. 440 plus 246 equals 686 calories. The weight of the baby is 14 pounds, divided by 2.2 (or multiplied by $\frac{5}{11}$) equals 6.4 kilograms. The baby should have 100 calories for each kilogram of its weight; 100 times 6.4 equals 640 calories. And the 686 calories we found the food to contain is more than sufficient, and close enough for all practical purposes.

If we wish to figure the baby's caloric need first and then prepare the food, it is possible to do so with reasonable accuracy by means of the following simple plan:

The baby weighs $12\frac{1}{4}$ pounds, or 5.5 kilograms. 5.5 times 100 equals 550 calories, which is the daily need. In order to ascertain how many calories must be supplied by means of whole milk, we must subtract from this total the number of calories contained in the sugar which must be added. For babies under six months it is usually necessary to add about 5 per cent. of sugar to the diluted milk; a baby weighing $12\frac{1}{4}$ pounds would take about $5\frac{1}{2}$ ounces six times a day, or 33 ounces; 5 per cent. of 33 ounces equals 1.6 ounces, the amount of sugar to be added. Reducing to grams, 1.6

ounces times 30 equals 48 grams. 48 times 4.1 (the caloric value of 1 gram of sugar) equals 196.8 calories, which subtracted from 550 calories, the twenty-four-hour total, leaves 350 calories to be supplied by means of whole milk. 350 divided by 20 (the caloric value of 1 ounce of whole milk) equals 17, and 17 ounces of milk must be used. The formula then would be:

Whole milk	17	ounces
Lime water (5 per cent. of 33)	1½	"
Sugar (twice 1.6 ounce)	3	tablespoonfuls
Water, enough to make	33	ounces

Feed 5½ ounces six times a day.

Now let us figure out how this results in percentages: We have 17 ounces of whole milk and 1.6 ounces of sugar in a 33-ounce mixture. The fat content will be $\frac{1}{3}\frac{7}{3}$ of 4 per cent., or very little over 2 per cent.; the proteid will be $\frac{1}{3}\frac{7}{3}$ of 3.5 per cent., or 1.8 per cent.; the sugar will be $\frac{1}{3}\frac{7}{3}$ of 4.5 per cent., or 2.3 per cent., to which we have added 5 per cent., making a total of 7.3 per cent. sugar. The mixture then contains:

Fat	2.0 per cent.
Proteid	1.8 "
Sugar	7.3 "

Assurance as to the proper food values of any food is not complete until we have assured ourselves that the daily amount contains 2 grams of proteid for each kilogram of body weight. This is very simple, as we have the percentage of proteid and the total amount of the feeding. In the above mixture there is a total of 33 ounces with a proteid percentage of 1.8. 33 ounces equals 990 c.c.; 1.8 per cent. of 990 is 17.8 grams, the daily amount of proteid. The baby weighs 5.5 kilograms, and twice 5.5 equals the amount of proteid the food should contain, which is 11 grams. The actual amount, 17.8 grams, is far in excess of this. As mentioned before, there is little likelihood of having too little proteid in whole-milk mixtures if the fat is of the requisite amount.

It is, of course, possible to figure the caloric value of any food in which the percentages of the constituents are known. This is the plan to be pursued in percentage feeding. Take as an example a mixture of 28 ounces containing 3 per cent. fat, 1.5 per cent. proteid, and 7 per cent. sugar; this being fed to an infant weighing 11 pounds. 28 times 30 equals 840 c.c., the daily amount reduced to cubic centimeters. The fat is 3 per cent. of 840, or 25 grams; 25 times 9.3 calories (the amount in each gram of fat) equals 232 calories. The proteid percentage is 1.5 and the sugar 7; since each of these has a value per gram of 4.1 calories they can be figured together. 1.5 plus 7 is 8.5 per cent.; 8.5 per cent. of 840 is 71 grams of both proteid and sugar; 71 times 4.1 equals 291 calories. This added to 232 calories of fat is 523. The baby weighs 11 pounds, or 5 kilograms, and should therefore have 500 calories per day. Therefore our mixture is not only sufficient, but is nearly exact.

When whey is used, or starches, or condensed milk, or proprietary foods, the caloric value becomes more difficult to determine and the results less exact. But even then the approximate values can be obtained. And it is in these very cases, particularly those fed on proprietary foods, that it is often necessary or advisable to know the caloric value of food according to the child's weight. And, in these cases also, it is often of primary importance to find the amount of proteid per kilogram of weight.

SPECIAL FOODS.

Whey.—There are certain cases, particularly very young or premature infants, in which the food is better digested if the casein is removed. This may be due to the large tough curd which the casein forms, to some chemical difference between the casein of cows' milk and human milk, or to the fact that the casein renders the other constituents less easy to digest. Such children are usually ill, or convalescent, or have been badly fed before. Whatever the reason, the fact is established by many observations. And it has been responsible for the use of milk from which

the casein has been removed, the so-called whey. This is prepared by warming the milk to the body temperature, being certain that it is not over 100° F. Add two teaspoonfuls of essence of pepsin for each pint and shake or stir a few seconds. Let stand until firmly coagulated, usually only a few minutes. The curd is thoroughly broken by stirring and then strained through cheese-cloth. If allowed to drip completely, a pint of milk will make two-thirds of a pint of whey. It must be heated to scalding after being strained if it is to be added to milk or cream, otherwise it will curdle the casein. For practical purposes whey may be considered to contain 1 per cent. each of fat and lactalbumin, the other elements being the same as in the whole milk. Of course it can be used alone for a short time only, as its food value is low. For infants who are in poor condition and need readily digestible food, it is often used with cream or sugar, or both, added to increase the food value. Even this should not be used longer than is needful, but changed as soon as possible to a mixture containing more casein. It is generally best to accomplish this by adding milk in very small amounts, increasing by the same amount daily, as toleration is manifested, until the whey can be discontinued.

Junket.— This is a preparation of milk used for older infants and children, the indications being much the same as in the use of whey. It is prepared in the same manner as whey but the curd is not broken up; it is flavored with vanilla, wine, etc., and eaten as any jelly-like substance.

Peptonized Milk.— The use of peptonized milk is probably much less common than it was a few years ago. Its only effect is to render the casein curd much finer, or if the process is carried out for an hour or more, to render all the casein soluble and do away with the curd entirely. When the peptonizing process is carried on longer than six minutes, the milk becomes distinctly bitter; therefore when modification of the curd only is required, the process should be stopped by boiling after six minutes.

The peptonizing agent is pancreatic extract, and sodium bicarbonate must be added enough to alkalinize the milk—trypsin acting only in an alkaline medium. The milk is

warmed to about 100° F. and the soda and pancreas extract added; it may be boiled after proceeding the proper length of time, if it is to be kept any length of time; or may be fed at once after peptonizing. An excellent plan is to divide the proper amount of soda and extract in as many small portions as will suffice for the number of bottles during the day; the prepared bottle of milk is warmed, the powder added and shaken, and after two minutes given to the baby. The feeding will usually be finished before the milk has become bitter enough to be rejected; 5 grains of extract with 15 grains of soda is enough for a pint of milk. The use of this milk is, of course, confined to those cases of acute illness or poor digestion from some cause, where the casein is digested with difficulty. Its use should be limited to as short a time as possible because it is not wise to accustom the stomach to a predigested food and so hold in abeyance its proper powers of digestion.

Malt Soup.—This food is indicated where the tolerance for carbohydrate is high and the ability to digest proteid and fat is low. It is apt to produce a rapid gain in weight in infants who digest it without difficulty. The best known preparation is that of Keller. Malt extract is prepared and mixed with potassium carbonate for the market. Three ounces of this is dissolved in two-thirds of a quart of lukewarm water; 2 ounces of wheat flour is rubbed up with a small quantity of milk and this mixed with one-third of a quart of milk; the two mixtures are poured together with constant stirring, and at the same time the liquid is quickly heated; it is then allowed to cool slowly. When cold, it is placed on ice. For young infants a weaker mixture can be made by using less of all ingredients.

Egg water.—This is prepared by mixing thoroughly the white of one egg with water and adding a little salt. If the white of one egg is mixed with 10 ounces of water it makes a solution containing about 1 per cent. of albumen. If a small amount of sugar is added, the child will usually take it a little more readily and it contains a little more nourishment. It may be more palatable if shaken up with orange-juice. This mixture is one of the best foods we have

for temporarily feeding infants with digestive disturbances when we wish for a time to do away with the milk feeding. Needless to say, it contains so little nourishment that it will do for only very short intervals, or to use alternately with other food.

Beef-juice.—This is usually used as an addition to the diet, but also when an unusually digestible food is required. The most economical way of making it is to cover one pound of finely cut raw beef with half a pint of water and let stand on ice for twelve hours. It is then strained by squeezing through muslin, and seasoned a little with salt. This is known as beef tea. A better product, but more expensive, is made by slightly broiling a piece of beef and then squeezing with a meat press or lemon squeezer. Beef-juice contains about 2.5 per cent. of proteids and from 2 to 3 per cent. meat extractives; the latter are principally of importance as gastric stimulants.

Scraped Beef.—This is another valuable and easily digested food. It has the advantage of containing a very high percentage of nourishment. It is made by scraping with a dull knife about a tablespoonful of beef, so as to have it finely divided. Make a small cake and broil slightly on both sides, after flavoring with salt.

Broths.—The value of these as foods is very much overrated, and is due mostly to the extractives they contain; the proteid is only about 1 per cent. When thickened with flour they are much more nourishing. They are best made by first soaking one pound of lean beef, mutton, veal, or chicken in one pint of water for two hours; then cook with moderate heat for two hours, by which time the volume is about one-half pint.

Cereals.—The use of thin cereal gruels has been referred to before. The one most used is barley water, and is best made from the flour. It is used alone or as a diluent for the milk. It has very little nourishment, and is used only to partially satisfy hunger during a period of nearly complete starvation. Barley water is made with two teaspoonfuls of barley flour to a pint of water and boiling fifteen minutes. With the grains it is advisable to first soak them two or three

hours and then boil for six hours, and strain. It then contains about 1.5 per cent. starch. A thicker and more nourishing jelly is obtained by using a larger proportion of barley.

Gruels or jellies of oatmeal, wheat, rice, arrowroot, tapioca and others are made in the same general way. They are indispensable for the addition of starch to the diet after six or eight months. As mentioned before, barley has a slight tendency to check diarrhea, oatmeal slightly the reverse action; the others have practically no effect on the stools.

Buttermilk.—Buttermilk has become a prominent factor in the feeding of infants of recent years, due chiefly to the low content of sugar and fat, and the presence of considerable lactic acid. The latter element makes it particularly useful in intestinal infection. It contains the casein finely precipitated and never forms large curds. It may be used diluted with water, with cereal decoctions, sweetened or unsweetened; it is seldom necessary to dilute it more than one-half. Its food value, of course, is not as great as that of sweet milk, notwithstanding the popular notion.

It is much more difficult to obtain uncontaminated, and great care should be exercised in procuring it. A similar product may be made from sweet milk by the addition of lactic acid bacilli, now conveniently marketed in tablets. The milk is warmed to about 90° F. and the tablet broken up and shaken in the milk; it is then allowed to stand about twelve hours at room temperature; it may then be used or put on ice. If it is a good product, it will keep two or three days if kept cold. Prolonged fermentation produces an unpleasant acidity.

Casein Milk (*Eiweissmilch of Finkelstein*). — The need which this milk is intended to fulfill is that of a food low in sugar and in salts, with moderate fat, and comparatively high proteid, of which the greater part is casein. This is a valuable food in disturbances due to fermentation, or where both sugar and fat are not digested properly, and the salts in the usual amount not well borne. It is low in caloric value and cannot be used exclusively for more than a very few days. Calories are easily added by the addition of sugar. Its preparation as done by Finkelstein is difficult, indeed

almost impossible in the home, and its use practically is limited to hospital feeding. A number of modifications have been used with tolerable success. It is made as follows: Enough rennet (essence of pepsin) is added to a quart of milk to coagulate the casein. The curd is broken up and the whey strained through muslin for one hour. The curd is then rubbed through a fine hair sieve; this is an important point in the process, as the curd is here made fine enough to go through the nipple; it may have to be run two or more times through the sieve. It is then intimately mixed in one pint of water and a pint of buttermilk is added. When it is necessary to add sugar to this food, it is advised to use a dextrin-maltose mixture; in this country Mead's dextrimaltose is used. This milk contains fat, 2.5 per cent.; proteid, 3 per cent.; sugar, 1.5 per cent.; salts, 0.5 per cent.

Condensed Milk.— The use of this product in infant feeding is wide-spread and is due primarily to convenience of preparation and lack of proper understanding of intelligent infant feeding. It has a place in infant feeding when used for a short time to prepare a baby for the proper digestion of suitable food. Its composition is given by Holt as follows:

Analysis of Borden's Eagle Brand Condensed Milk.
(From Holt.)

	Condensed milk.	Six parts of water added.	Twelve parts of water added.	Eighteen parts of water added.
Fat	9.61	1.37	0.73	0.50
Proteid	8.01	1.14	0.61	0.42
Sugar (cane, 42.91; milk, 12.03)	54.94	7.89	4.75	2.90
Salts	1.78	0.25	0.13	0.09
Water	25.66	89.35	94.28	96.09

The ease with which it is digested is due to the very low fat and proteid content, and the great amount of sugar makes it possible for a baby to gain very rapidly in weight. Such babies are poorly nourished, however, and have slight resistance to disease. Prolonged use of it exclusively nearly always results in rickets, sometimes of extreme degree; scurvy also has been reported from its use. As a temporary diet it is useful in acute illness and poor digestion.

Infant Foods.—The one most important thing to know about all the proprietary infant foods, in which condensed milk is included, is that not one of them is a proper food for the infant for any length of time, and none of them should be used when cows' milk will be properly digested. And suitably modified milk will be digested in the vast majority of cases. There is no question about the frequency with which disorders of nutrition, notably rickets and scurvy, follow their prolonged use. And they have not the advantage of being inexpensive.

But, as was stated under Condensed Milk, they are sometimes useful as a temporary diet when milk cannot be obtained, during or after acute illness, or during some difficulty of digestion, when the infant cannot properly digest cows' milk. The fault in all cases lies in the large amount of carbohydrate and the much too small amount of fat and proteid; also in the absence of the "live" principle of raw cows' milk.

They may be divided into three classes: those containing principally soluble carbohydrates, dextrose, maltose, dextrin; those containing unchanged starch added to dried, sweetened milk; and those composed principally of the cereal starches. They need no other comment.

To the first class belong Mellin's, Eskay's, Liebig's, and Horlick's. To the second Nestlé's, Angle-Swiss, and Gerber's. To the last Imperial Granum, Robinson's Barley Flour, and Hubbell's Prepared Wheat.

Condensed milk is also carried one step farther and marketed as a dried powder. It has not the added sugar, and when mixed with eight parts of water, approximates the original milk.

Any of the above foods are best used in combination with fresh milk, and most of the manufacturers now advise that procedure. In this way they are at times of undoubted value in difficult feeding cases. But they are generally used on the "hit or miss" plan, and not selected because one is better suited to one sort of condition than another.

Feeding in the Second Year.—By the time a child has entered the second year it should be taking nourishment

only five times a day, or often only four times. We have noted a few simple additions to the diet in the latter months of the first year. Nothing more may need to be added for several months in the second. The infant's stomach is probably more grossly abused during its second than its first year, because it is often deemed ready for anything by that time. The same regularity should be insisted upon and the child should not be fed between meals. The diet consists mainly of milk, usually about a quart a day, stale bread, crackers, cooked cereals with cream, butter, eggs, beef-juice, or meat broths, orange-juice, and the pulp of cooked apples and prunes. At the middle of the second year it is wise to begin giving vegetables in the form of thick gruel; carrots, turnips, cauliflower, peas, beans, spinach, and asparagus tips may be given in this way. Milk need not be diluted. A sample diet is something as follows, always remembering that some children may with impunity take a greater variety:

7 A.M. Cereal, egg, 6 to 10 ounces of milk.

10 A.M. Eight ounces of milk with cracker or bread-crust.

1 P.M. Broth or meat cake or vegetable gruel; bread or cracker; milk.

4 P.M. Eight ounces of milk.

7 P.M. Tablespoonful of cereal with cream; 6 to 10 ounces of milk.

Orange-juice or fruit may be given at any meal or more than one.

Feeding in the Third and Fourth Years.—Four meals are sufficient during this time, and sometimes only three. It is hardly advisable to feed only three times a day, though this may be done where it seems well tolerated. It is more likely to lead to the abuse of "piecing" between meals. Of course, the gradual transition to the adult diet is taking place rather indefinitely, and it is harder to lay down general rules. The vegetables and fruits are given more freely, and small portions of meat given once a day. Bacon, in particular, is helpful for variety in the second year. Cereals may be given well flavored with butter if the child does not like them with milk or cream; it is best to give them unsweetened. The best vegetables are those enumerated above, and they

may be given in other forms than the gruel, always simply and thoroughly cooked. The best forms of meat are bacon, beef, lamb, mutton and chicken. Simple desserts, as rice- and bread-pudding, corn-starch, flavored gelatin, and simple preserves. The food should always be simple, never highly seasoned, and the child should learn to eat what is prepared for it. It is a bad plan to prepare this and that and the other thing for a healthy child and encourage him to ask for something else because what is prepared does not happen to suit his fancy at the time.

CHAPTER VI.

DISORDERS OF DIGESTION AND NUTRITION.

The most distracting part of a study of children's diseases is that of disorders of the stomach and intestines. Our knowledge of the digestive abnormalities has been arranged and classified in such a way that it was of little value to the average practitioner. Making a definite diagnosis in the individual case was next to impossible, disturbances due to overfeeding, to fat, to sugar, or to anything else, being classified and treated simply as indigestion, of greater or less severity. No clear idea was given of the similarity of food intoxication to infection, and acute illness with high fever was usually assumed to be due to infection. The result was chaos, and the value of a text-book in the recognition and treatment of these disorders was slight.

Within the last ten years an immense amount of work has been done to ascertain the actual causes of the various digestive disorders of infancy, with the result that a fairly definite classification of them has been offered. Many changes are no doubt yet to be made; some of the assumptions perhaps will be found to be erroneous; some measures of treatment are subject to great modification and possible improvement. But a start has been made in a scientific and understandable classification. For this we are indebted in great measure to the work of Czerny, Keller, Finkelstein and many others, and in this work advantage is taken of Finkelstein's classification.

This, it is found, renders needless some of the terms found in other text-books, and which have long been the names for gastro-intestinal diseases; and it is surprising how the great majority of cases will be found to correspond in symptoms to the new scheme, whereas under the old plan one was at sea much of the time.

In dealing with faulty digestion and nutrition we are still obliged to assume many things. Digestion, absorption, and metabolism are so blended that it is often impossible to tell which particular activity is at fault. Sometimes babies will apparently digest their food perfectly and yet fail to gain because of inability to absorb or assimilate it properly. This will produce the picture of a disorder of nutrition similar to that caused by a deficient food. For instance, some children develop rickets when the food has apparently been sufficient in all particulars and properly digested. Certain clinical conditions, eczema, colic, acidosis, frequently occur in children in apparently perfect health and with perfect digestion, and yet they are often amenable to some change in the diet and to nothing else. So rickets, scurvy, spasmophilia may at times conceivably be due to a disability of absorption or metabolism, though generally due to insufficient food of one sort or another.

It seems rational therefore to describe under the same heading the conditions which follow faulty digestion and those presumably due to the use of food deficient in one or another essential element.

VOMITING.

Too much stress should not be laid on vomiting. Infants expel the contents of the stomach very readily because of the nearly vertical position of that organ; older children also vomit with much less provocation than adults. Frequent, persistent vomiting has some underlying cause which should be investigated and, if possible, removed. Inasmuch as the common causes of vomiting differ very widely, and as there are certain distinctive features about types of vomiting, an attempt is here made to classify them.

Simple regurgitation is very common, particularly with breast-fed infants with a large milk supply. It usually comes very soon after nursing, and there are no evidences of discomfort connected with it. It may be caused by undue movement of the child after nursing. Often it is induced by eructations of gas. This type usually needs no attention.

If due to persistent overdistention of the stomach, it may be controlled by lessening the amount of the nursing.

Vomiting due to digestive disturbances is more copious and attended with other evidences of illness. Dyspepsia is much the most frequent cause, following the use of too rich food, too much food, or some food entirely unsuited to the child's stomach. The vomitus consists of nearly the whole of the contents of the stomach, often considerable mucus, and, if frequent or prolonged, is stained with bile that has passed through the pylorus from the duodenum. This type of vomiting usually comes a considerable time after feeding. It is sometimes a serious condition and very hard to control.

In pyloric stenosis, and to a less extent in pylorospasm, vomiting is much the most prominent symptom. Here the vomiting is projectile and continuous, and practically the entire amount of each feeding is returned. Projectile vomiting of this sort cannot be distinguished from that due to cerebral tumor or injury or meningitis, except by other symptoms occurring with it. Obstruction of the bowel is always accompanied by vomiting. It also is apt to be projectile, but has at times a marked characteristic, *i. e.*, it contains fecal matter and has the characteristic odor of feces; this is called stercoraceous vomiting.

Many cases of acute infectious disease are ushered in or are accompanied by vomiting. This is of the same sort as that of dyspepsia, and varies greatly in degree. Most commonly it is seen in scarlet fever, meningitis, influenza, pneumonia, malaria and during the course of whooping-cough. Appendicitis nearly always causes early vomiting, as does any sort of acute peritonitis.

The syndromes known as uremia, cyclic vomiting, and other obscure conditions in which vomiting occurs are due to the presence in the blood of some toxic product formed, presumably, in the body itself.

Vomiting is readily induced, particularly in infants, by simply touching the back of the tongue or the wall of the pharynx. This it is well to remember when examining a child's throat. Some children have the vomiting habit and are able to empty the stomach at will. The habit sometimes

is so persistent that only the strictest discipline will overcome it. It is apt to follow whooping-cough or some other chronic cough that is so violent as to cause frequent vomiting spells.

COLIC.

This term has been much abused in its relation to infants because it has been considered largely as a disease rather than a symptom, particularly by the laity. It is a name applied properly to any severe, paroxysmal pain in the abdomen. It may be due to appendicitis, peritonitis, pancreatitis, or any acute inflammation or injury. In some very severe cases the attacks have been assumed to be due to transient intussusception of the bowel, and this well explains such attacks. Generally, it is used to designate the pain that accompanies practically any sort of indigestion or intestinal disorder in infants. It is commonly an indication of difficulty in digestion and stops when the baby is given food it can readily digest, or becomes accustomed to the food it has been taking. It may be caused by any of the food elements, but most often by sugar or starch and proteid. It is very frequently accompanied by constipation, and sometimes apparently due entirely to the constipation. Early infancy, from birth to three or four months, is the period in which it is most common. Usually by this time the afflicted baby is able to properly digest its food. One remarkable thing about the condition is the amount of screaming and struggling an otherwise healthy child can do and still retain strength and vigor, and regularly gain in weight.

Symptoms.—In severe cases these are almost unmistakable; and it is most severe in highly nervous and in delicate babies. The cry is evidently just as loud as the infant can possibly make it, which is hushed for a minute and then suddenly begun again. The legs are drawn up tightly on the abdomen and suddenly kicked out again; the abdomen is tense, but relaxes perfectly in the intervals. With the expulsion of gas the symptoms subside and the infant is perfectly comfortable, falling asleep quietly. Sometimes firm, gentle pressure on the abdomen relieves the pain momentarily. A disconcerting

fact is that these babies usually take food eagerly during the attacks, leading one to believe that the crying is due to hunger; but, very shortly after, the crying begins with renewed vigor. In severe attacks there may be prostration, pallor and cold extremities, with the appearance of complete exhaustion. With milder attacks there is fretfulness, with occasional hard crying, and the child sleeps very little. Some children have chronic colic pains to such an extent that they will not have a restful night's sleep in months. And this is usually harder on the other members of the family than it apparently is on the baby.

Diagnosis. This is usually easy. But one should always bear in mind the possibility of grave intestinal trouble, notably appendicitis and intussusception; also other obscure causes of sudden, severe pain, as earache. Simple colic is not accompanied by fever, and the paroxysmal cry, firmly flexed thighs and rigid abdomen, and the sudden, complete relief, are characteristic.

Treatment. This, of course, should be directed toward securing a suitable food, or regulating the feeding if the child is on the breast. Often the nursing interval should be lengthened; it should never be shortened. Often no change of any sort affords much relief. Usually the proteid or the carbohydrate must be decidedly lessened.

For the relief of the symptoms a number of mechanical means can be employed, none of them being successful with any regularity. The one most valuable measure is the inflation of the colon with from a pint to a quart of warm water, allowing it to run in slowly, under slight pressure, and stopping the flow when the child struggles hard. A simple low enema or suppository may suffice. Hot applications to the abdomen, particularly having the child lie on a hot-water bottle; gentle pressure and massage of the abdomen to expel the gas; in moderate colic all these are of some value. Drugs occasionally are of value. Opium, in the form of paregoric, will of course quiet any and every attack if given in sufficient amount. Its use should be avoided as much as possible; in fact, it is best not to use it at all unless one is very sure of his ground; this surety is acquired only

by experience. Any of the carminatives, as whisky, ginger, asafetida, peppermint, catnip and fennel, are of service occasionally and can hardly do any harm. They should be given with a considerable amount of warm water; it should be borne in mind that it is easy to overdo the whisky.

Special attention should be paid to constipation. As this is largely a matter of diet, it will respond often to correction of the food.

CONSTIPATION.

Chronic constipation is a frequent disorder of childhood, and particularly of infancy, and there is great difficulty in its satisfactory management. It represents a condition in which the bowels are not emptied often enough, or where the feces are too dry and hard, but of normal frequency.

Etiology.—The difficulty may lie in the food or in some abnormality of the intestinal tract; much oftener it is the former.

Intestinal inefficiency is usually due to poor muscular contraction of the intestinal wall. This may be due to congenital fault, but in the great majority of cases is due to malnutrition of some sort, the commonest being rickets. Habit is a strong factor, particularly in older children, as constipation soon results from neglect to go to stool when the desire manifests itself. Decreased intestinal secretion and of the secretions of the liver are sometimes the cause, the feces then being light in color, dry, and usually of very offensive odor. Prolonged diarrhea often leads to constipation, presumably by causing atony of the walls of the intestines. Anal fissure or any painful condition about the anus, may cause constipation by resistance to the painful act of evacuation. Certain anatomical peculiarities rarely cause obstinate constipation, such as narrowing of the lumen of the large intestine, unusual length with twisting, the pressure of tumors in the abdomen, or a persistent spasm of the anal sphincter.

When the fault lies with the food, it is oftenest due to too little or too much fat; a food too rich in fat, which for some infants may mean a comparatively small amount, will almost

certainly induce constipation, if it does not bring on acute illness. Next most common is a deficiency in total solids in the food, with too little of residue for the intestines to act upon; this is the constipation of insufficient food. Nurslings who are getting insufficient milk nearly always have constipation as one of the symptoms of too little food. Too little water seems theoretically a possible cause, leaving the stools too hard and dry; practically it is difficult to decide that this is the case in any given instance; certainly the mistake of giving too little water is often made. Prolonged feeding of sterilized milk tends to constipation, as does the use of too great quantities of milk in the second and third years to the exclusion of the proper amount of solid food.

One of the most prolific causes is the giving of numerous enemas, suppositories, or laxatives to a very young baby with colic or moderate constipation. There is no more certain method of producing a chronic constipation. Injudicious use of opium has the same effect.

In older children the lack of a proper variety in the diet, particularly the lack of green vegetables and fruit, may induce constipation, or fail in attempts to connect that which already exists. Lack of exercise is a potent cause, constipation being much more frequent in the winter than in the summer when the children are much out of doors. It is in winter that habitual disregard of the call to stool most often shows its harmful effects.

Symptoms.—The local symptoms are often all that are present, as the general health may remain very good and the nutrition does not suffer. Constipation is a relative term, but is usually properly applied to any person whose bowels do not empty themselves every day. The breast-fed infant usually has two or three stools a day for the first year; the artificially fed infant more often has only one. But the character of the stool, its volume, and the ease or difficulty of its discharge are of more relative importance than the frequency.

In the majority of cases of constipated infants there are present flatulence and colic. Mucus, or even blood, may be passed with the abnormal stool, and the action produce

severe pain. Hemorrhoids develop not infrequently, and the constant hard straining may be the cause of hernia. Fretfulness, disturbed sleep, or slight torpor associated with some fever, are frequent results; these are no doubt due to the absorption of toxic material from the intestines. During this sort of attack there is failure of appetite with coated tongue and perhaps foul breath.

In older children the symptoms are much more likely to be of the last-mentioned variety. Headache is a particularly common result, and languor, restless sleep with grinding of the teeth, poor appetite, and usually also the coated tongue and foul breath. Rarely the constipation becomes so complete as to cause the symptoms of bowel obstruction. Also there is occasionally a false diarrhea, produced by the irritation of hardened fecal masses that remain in one place in the bowel while frequent, thin bowel movements quite obscure the real cause.

Treatment.—This requires first the most painstaking endeavor to discover the cause. Sometimes this is easy; often it is very difficult or impossible. Either the food or the child's habits, or the physical condition may be at once evident as the cause. We can then treat the case intelligently, but correcting the difficulty is much harder than finding out what it is. Often we must work on one or another assumption without any very definite reason for it.

Prevention is the one most important item, and reading over the various causes indicates the means for preventing it. Regularity is as essential in the treatment as it is in the prevention, and the baby or child should be made to absolutely conform to this requirement. The infant only a few months old can be trained in regularity by holding it over the stool at the same minute every day, preferably in the morning. The older child should be made to do the same thing. This position should be maintained a reasonable length of time, and if no action is forthcoming it may be induced by the use of an oiled cone of paper or a soap pencil. Care should be taken to see that the stool is not too high, making the child assume an unnatural, strained position; it should be low enough so that the feet rest on the floor.

In a breast-fed child make, or have made, a chemical examination of the mother's milk, and if some discrepancy is found, as insufficient breast milk, or abnormally low fat, take measures to correct it. One bottle of modified cows' milk a day will sometimes suffice. In bottle-fed babies it is very easy to change the milk formula as it seems to be indicated, usually increasing or decreasing the fat or the total solids. In every case give plain water, or oatmeal water, freely. It is well to substitute maltose, or dextrin-maltose combinations, for the other sugar used; this nearly always has some laxative effect. If the milk has been sterilized, this measure should be discontinued.

In older children the addition of fruits and green vegetables, or an increase in the amount used, should be attempted; orange-juice, stewed prunes, cooked apples, peaches — or even raw fruit, in season; with well-grown children, spinach, string beans, carrots and turnips are among the helpful vegetables. Massage of the colon, if resorted to, should be persistent, ten minutes daily before the time the child is to be put on the stool. In the same way muscular exercise should be a matter of regular routine, aside from the time the child spends in the exercise of play. If rachitis or malnutrition exist, of course the constipation will disappear only with the proper treatment of them.

There are three general measures for the immediate relief of the constipation itself—suppositories, enemata, and drugs.

If the constipation is due to sluggishness of the rectum only, suppositories are of value. Those made of soap, glycerin, and gluten are all effective; gluten is the least objectionable for frequent use, as it is the least irritating; frequently a small cone of paper covered with vaselin does exactly as well as any of them, and is least likely to cause irritation from constant use. Any of these should be greased or warmed before insertion.

The use of enemata is decidedly less preferable, but usually more effective. Plain water, soap water, glycerin and water, or sweet oil may be used. They result not only in cleansing the colon, but excite reflex peristalsis in the small gut. It is best to use small quantities so as not to dilate the intestine too

much. Their effect wears off in time, particularly if large amounts of fluid are used. The use of oil is the preferable measure.

Drugs are very unsatisfactory for prolonged use. Tolerance to all of them is readily established and each soon loses its effectiveness. There are two exceptions to this rule, but unfortunately they produce good results but seldom. Both are worth trying. These are agar-agar and neutral mineral oil. The oil is inert and non-absorbable and acts only as a lubricant; it may be given to babies, a teaspoonful three times a day—to older children in proportion. It certainly helps wonderfully in some cases, but has not been in general use long enough to determine its real value. Agar-agar can be used only with older children. It is given mixed with some moist food, a teaspoonful two or more times a day. In this way it forms a large, soft, gelatinous mass that softens and enlarges the stool. It also is inert and non-absorbable. A few cases of obstinate constipation have undoubtedly been cured by its use, but it is not easy to get a child to take it regularly; often they will not take it at all, though it has no taste.

Of the laxative drugs, the best are milk of magnesia, cascara, or nux vomica combined with belladonna; phosphate of sodium and phenolphthalein are next best. They should be used as little as possible, as a cure can hardly be expected. Olive oil or cod-liver oil given twice or three times a day may help, particularly if the trouble is too little fat.

DIARRHEA.

By this term is meant the frequent, loose bowel movements that occur as a manifestation of increased peristalsis or increased secretion of the intestines.

Etiology.—Diarrhea occurs from such a variety of causes and in so many conditions that it is impossible to enumerate them all or to know them all. Its importance as a symptom may be summed up in the statement that about one-third of the deaths of infants under one year are due to diseases accompanied by diarrhea, that is, to gastro-intestinal diseases.

In analyzing the death-rate of children in the city of St. Louis for 1911, 1912, and 1913 it was found that deaths due to gastro-intestinal disease associated with diarrhea in infants under two years were greater than the total deaths under five years from measles, whooping-cough, diphtheria, and scarlet fever.

During the first year the infant is extremely susceptible to disorders of the stomach and intestines, and this is especially noted in the artificially fed. Any illness the child may develop lessens its resistance, and it is then even more subject to gastro-intestinal disease; a fatal diarrhea is often the result of some other illness. The onset of diarrhea in a previously sick baby is always to be viewed with alarm.

Diarrheal diseases are particularly frequent in the large cities in the hot weather, and among the children in the poorer, crowded districts. Many factors unite in the production of diarrhea in these cases: heat, contaminated milk, ignorance and neglect; but the prime element has yet to be determined and will not be discussed here; the conditions that need changing are manifest.

The one most prolific cause is artificial food, whatever the particular item may be. Infants who are properly fed on the breast develop fatal diarrhea in less than 10 per cent. of the cases.

Chronic disorders of nutrition are prone to result in acute diarrhea; rickets, malnutrition, marasmus, scurvy. And all offer a poor prognosis.

The acute infections of parenteral origin frequently result in diarrhea; coryza, bronchitis, pneumonia, measles, and others. In pneumonia it is a distressing and alarming symptom.

It is a matter of common observation that dentition in some babies is regularly the cause of a moderate diarrhea. This is simply evidence of the great vulnerability of the intestinal tract.

A single feeding of grossly improper food occasionally causes a fatal diarrhea, and slight liberties taken with the child's digestion often produce a minor attack.

Symptoms.—These need little discussion. The essential fact is the appearance of any number of loose, watery stools

or largely mucus. Oftenest the color is green, either light or dark; it may be yellow, bloody, or if composed mostly of mucus may have very little color. Usually there are as many as four, and may be twenty or thirty. The general symptoms depend entirely on the severity of the diarrhea or associated disease. A baby can be brought to a point of apparent lifelessness in one day by a severe diarrhea.

Treatment.—It is hardly possible to discuss the treatment of diarrhea under a general heading, as the causes and conditions vary so much. Prevention offers a greater field for success than cure. Procuring pure milk for bottle-fed babies, or sterilizing that which is doubtful, is the most important measure, and is necessary in hot weather. Lessening the amount of food a child takes in the beginning of an acute illness is always advisable, as the digestion is nearly always somewhat impaired; also we should be more cautious than ever of the sort of food given at that time. With the onset of diarrhea the first step is to stop food entirely for a day. It may soon be evident that the child can take small amounts of very simple food, but it is best in the beginning to stop it entirely. An efficient laxative is given to clear the intestines, castor oil and calomel being the best. Any sort of feeding should be carefully instituted, giving much less than the child was taking before the onset of the diarrhea; it must be remembered that with a young infant it is dangerous to keep on a starvation diet more than forty-eight hours, and delicate babies not more than one day.

Drugs to control very frequent bowel movements are often of great benefit, and, excepting opium, rarley do any harm. Bismuth is the one most generally employed and is probably the most efficient and safe of all the astringents; it may be given in doses of from 10 to 20 grains four times a day. Opium is indicated when there is much pain or very active peristalsis, or sometimes to insure some sleep for a very restless, exhausted child. It must be employed with caution, particularly in weak or very sick babies. Neither drug should be employed until the intestines have been well cleared. With very frequent, small, mucous stools a valuable remedy consists in the use of high irrigations with a thin starch water.

A pint or more may be used to flush out the colon two or three times a day.

Inasmuch as great quantities of water are lost from the body by very frequent stools, it must be supplied. If the child will not take water, or vomits what is taken, the need may be supplied by giving water or physiological salt solution by rectum, or by injection under the skin. Given in the rectum, it must be introduced very slowly, allowing a pint to flow though a catheter so slowly that it takes one-half to one hour; this may be done two or three times a day. Subcutaneously, injections of salt solution may be given in the tissue of the abdomen or pectoral area, from two to four ounces three times a day, as the symptoms indicate.

MALNUTRITION.

Definition.—This is not a definite disease in itself, but a condition in which the powers of digestion, assimilation and metabolic activity are manifestly deficient. There are no signs or symptoms of disease of any of the organs.

Etiology.—Many of these children are delicate from birth, with no reason that can be said to be responsible for their condition on the part of the parents. Some have a definitely bad heredity, the parents being delicate, or afflicted with some debilitating disease—excessive nervousness, tuberculosis, syphilis, etc. Many children in cities, where the conditions of crowding, bad sanitation, poor air and improper, insufficient food are common, show this physical condition.

In older children malnutrition may be a continuation of that existing in infancy or may be acquired by the above conditions; more often it is due to some serious illness which leaves the child in a weakened state for many months.

Pathology.—There are no distinct pathological changes due to malnutrition. Death is nearly always due to some acute disease, or the result of marasmus.

Symptoms.—In infants the most striking thing is the failure to gain in weight for weeks and months; the weight may be the same for weeks at a time, or even show a loss, or a slight gain in a very irregular fashion. Other things, strength, the

desire to play, etc., show imperfect development. Anemia is constant but usually not as great as the general condition would lead one to expect. These children are always fretful, sleep poorly, and are apt to be badly spoiled because of the attention demanded to comfort them.

They are extremely subject to attacks of indigestion, often being upset by the slightest change in the amount or quality of the food. A slight coryza, or other simple infection that the ordinary child would readily throw off, may become a serious illness. In this way malnutrition often progresses to the condition known as marasmus.

Older children present the same general features of underweight, weakness, flabby muscles, and anemia. They are also extremely subject to infections, particularly bronchitis and coryza, and the attacks are apt to be prolonged. They are also frequently the victims of a long train of nervous conditions which often continue throughout life if the disturbance of nutrition is not corrected.

Prognosis.—In most cases this is good if the underlying cause is detected and removed. A hereditary taint makes the task a more difficult one and the greatest care has to be exercised throughout childhood. These children naturally have slight powers of resistance and intercurrent diseases are very likely to prove fatal.

Treatment.—This consists entirely in securing the proper surroundings, proper care, and proper food. In no other condition is it more necessary to have plenty of fresh air and sunlight, exercise (active or passive), and absolute regularity in eating and sleeping. The best food for infants is breast milk; many of them can digest nothing else, and will die if it is not obtained. Artificial feeding will require the greatest care and attention, and is largely a matter of careful experiment in the individual case. The utmost caution must be used in giving the child a new food or increased amount.

It is impossible to feed such a child as we would a vigorous one at the same age; they are always months behind in digestive development. Increase in or additions to the food must be made in small amounts and frequently, as tolerance is manifested.

Fresh air and exercise are imperative. The child should live in the open air as much as possible, and sleep in a freely ventilated room at night; out-of-door sleeping is better still. The infant should have daily rubbings, with passive movement of the body and limbs. The greatest mistake is to keep such a child bundled up, lying in one place and in one position the greater part of the time. Older children should be made to go out in the open air and encouraged by every means to take the exercise they are usually strongly averse to.

Bathing is beneficial if the child reacts properly after the bath. Tepid baths, becoming cooler and cooler, should be used as the child can stand them. The crying and struggling they elicit are of decided benefit. Brisk rubbing should follow the bath, and the reaction of warmth always looked for.

Medicines have very little place in the treatment of this condition, and then usually with the older children. Iron may be used to correct the anemia if it is well borne; often it is not. It is doubtful if stimulating tonics, such as alcohol and strychnine, are of much use, but they may be tried; they seldom do any harm if used judiciously.

INANITION.

Definition.—This is a condition in which there is rapid loss of weight, strength, and activity due to lack of nourishment, and not to illness of any sort that can be determined. It nearly always occurs in the first few days of life. Those cases accompanied by high fever have been called by Holt "inanition fever."

Etiology.—The cause is undernourishment, usually almost complete starvation, for several days. Failure of breast milk, inverted nipples, cleft palate, refusal to take food, either from lack of appetite or from illness, are the most frequent causes. Analogous conditions due to other pathological lesions as pyloric stenosis, decomposition, etc., are not considered. This condition is distinguished from them, as well as from other nutritional disturbances, by the immediate gain in weight and improvement in every way on the administration of food.

Symptoms.—The only reliable sign is failure to gain in weight, or actual loss. Irritability, fretting; small, greenish stools, alternately loose and constipated, are most apt to be present. Evidences of hunger are not at all to be relied upon, as so young an infant usually indicates any discomfort in much the same way; signs of insufficient food have been mentioned in a previous chapter. But of greater obscurity are the many cases which present listlessness, apathy, sleep a great deal, and show none of the evidences of being hungry, and finally droop with weakness and exhaustion. In these cases the diagnosis can only be made by the weight, and by inquiry and careful observation as to the food the child has been getting. If one has not the thought of starvation in his mind, he is very apt to fail to correctly interpret these cases.

Equally misleading are the ones with fever. These are practically only seen in the first week. It is seen equally often in the vigorous and delicate, and was recorded by Holt in from 10 to 20 per cent. of newborn babies. The fever rises to 102° or 104° F., rarely higher, and continues for two or three days if nourishment is not given. Marked restlessness, dryness of skin and mouth, frantic attempts to suck anything in reach, and the very rapid loss of weight are the symptoms.

As lack of nourishment persists in any case, serious symptoms always manifest themselves. The loss of weight becomes more rapid, the pulse rapid and thready, the extremities are cold and the circulation manifestly poor, pallor and finally cyanosis develop; the latter is usually a terminal sign. Soon there comes a period of stupor in which it is very difficult to make the diagnosis. The urine is scanty and generally contains acetone. The bowels are nearly always quite constipated and the stools dark, scanty, and dry.

Prognosis.—In simple, uncomplicated cases where the trouble is early discerned, the outcome is favorable. The longer it continues, the greater the danger, and if there is some associated condition, as cleft palate, exhaustion from illness, or inability to assimilate the food, the outlook is not by any means certain. If a gain in weight in manifested at any time, the baby will probably recover.

Treatment.—Of course this consists in giving food, preferably always breast milk. If this is not possible, any sort of temporary food may be used with a healthy child. Others must be cautiously fed along the lines of delicate infants in other conditions. There is no indication or contra-indication for any special food element.

WEIGHT DISTURBANCE.

(Disturbance of Balance; Fat Constipation.)

Definition.—This is a minor form of disordered nutrition due to an intolerance of fat. Although there are conditions somewhat similar to it that cannot be definitely attributed to the fat and do not properly respond to low fat diet, such as are considered under Malnutrition, nevertheless weight disturbance is a distinct, definite disease in which accurate diagnosis and definite therapy are both possible. It is characterized by persistant stationary weight, or weight loss, and rather typical constipation.

Etiology.—The dominant role of the fat as the cause of this disturbance is conclusively established. It may be due to an unusually high percentage of fat in the breast milk or cows' milk, or there may be an inability on the part of the infant to properly digest and absorb a comparatively low percentage. It is practically only seen in babies fed on cows' milk. It occurs much more frequently among the babies of the better class of people, as they are more likely to be fed on a milk rich in fat. A fact that demonstrates the importance of cows' milk in causing the disorder is that in the early stages babies, if they are given human milk with a normal amount of fat, will often show a prompt steady gain in weight, whereas they will at once lose weight if the same amount of fat is given in a cows' milk mixture.

Symptoms.—The striking symptoms are failure to gain in weight without evidences of serious illness and with a sufficient amount of food, gradually progressing constipation, and restlessness and fretful crying, often associated with attacks of colic.

The weight often shows a characteristic tendency. It will

remain almost stationary for a week or two; then as the food is increased, instead of the expected gain in weight there is a sharp decline, the so-called "paradox reaction" of Finkelstein. This tendency increases as the food is increased until the baby becomes weakened and perhaps develops more serious illness to which it succumbs.

The constipation in the beginning shows itself in small, formed stools, not especially abnormal except that often they are passed only after the use of some artificial aid. They gradually change in color and consistency and finally become hard, dry, light gray or white in color, and with an offensive odor. The typical stool is so dry it readily crumbles and is passed with great pain. It consists largely of soaps which have been formed by combination of the fatty acids with the alkalies. The constipation may soon become very stubborn and take months to correct. Flatulence and colic are often associated with it.

These babies not infrequently show eczema, intertrigo, seborrhea of the scalp, coryza and bronchitis, these bring evidences of the condition of fat intolerance described by Czerny as "exudative diathesis." The urine is often strongly ammoniacal, resulting in excoriation of the diaper region; the parents then usually notice that the urine has a very strong odor.

The temperature is normal in simple weight disturbance. Sleeplessness and restlessness may be extreme and very troublesome. When the condition has existed for some time, the baby becomes anemic, pallid, with flabby muscles and evident weakness. If not properly treated, the condition passes into dyspepsia, intoxication, or some parenteral infection to which these babies are quite vulnerable.

Diagnosis.—This may be summed up concisely: Failure to gain without marked evidence of illness (in the early stages), cows' milk as food, persistent constipation with the light colored stools—these should at once direct attention to weight disturbance. Certain things may be misleading; the stools in the early stage may be nearly normal, except for the constipated appearance; or they may contain very many small soap curds and still not have the gray color. Again,

these babies are often extremely subject to infections of the throat and respiratory tract, and these may be thought to be the real trouble rather than the nutritive disorder. Generally the diagnosis is easy.

Prognosis.—This is excellent as far as life is concerned. The danger is that the condition may be allowed to go on until dyspepsia, intoxication, marasmus, or some acute infection develops. With early recognition and proper treatment it is nearly always cured.

Treatment.—If possible the baby should be given breast milk; if the condition has existed for a long time, it may be necessary to remove the fat from the milk but, as stated above, fat in the breast milk is much better borne than that in cows' milk. The stools and the general condition are a safe guide in determining whether this measure will be successful.

With artificial feeding the indication is absolute—to cut the fat down or remove it entirely. There are many different ways of doing this, and as they all seem to be successful when properly used, it seems best to use the simplest, *i. e.*, skimmed milk. Buttermilk, malt soup, flour and vegetable soups, the latter in older babies, all have their partisans. In beginning the treatment the food should be reduced far below the infant's actual need, perhaps representing only 60 to 70 calories per kilogram. The place of fat is supplied in a great measure by carbohydrates, as these are usually well borne. Malt-sugar with some form of starch is better borne than any other. The first day give half skimmed milk and half oatmeal water, in perhaps half the amount at a feeding the child was getting before. To this is added about 2 per cent. of maltose or dextrimaltose; in severe cases it is best to use malt extract rather than the sugar. Increases in the amount of food must be made cautiously, and only as the child shows tolerance for what it is getting by improvement in its condition; increase in weight is slow and in the beginning must be disregarded. When decided improvement is manifest, the fat must be added to the food. Extreme caution must, of course, be used here, and it is advisable not to increase the fat for a month or two if the child's condition is satisfactory.

It is best to begin with as small a quantity as one ounce of whole milk in the total quantity. This may be increased in the same way every other day unless the stools show the presence of soap curds. When the baby is showing a satisfactory gain and regains strength and vigor, it is well to keep it on the lowest percentage of fat that will give this result for two or three months. It is wise to increase the sugar and the fat at the same time, though greater liberty can be taken with the sugar. It should only be increased as indicated, however, and never exceed the amount on which the child thrives.

Treatment of the constipation, colic, restlessness, etc., is along the lines indicated in preceding pages.

DYSPEPSIA.

(Simple Diarrhea; Acute Gastro-intestinal Indigestion.)

Definition.—This is an acute nutritional disorder caused by gross errors of diet of any sort, and in young babies often due to too high fat or too high sugar content. It is characterized by rather sudden onset (unless it develop from some other illness), by vomiting, diarrhea, slight or sometimes high fever, and often by the many evidences of serious illness.

Etiology.—Overfeeding, too frequent feeding, or the feeding of improper mixtures of any sort are the most frequent causes. The condition is frequently seen in breast-fed babies but more often in those fed artificially, either those fed on cows' milk or the many prepared foods. It may be due to an excess of fat but more often the excess is some form of carbohydrate. With older babies it is more often due to giving some sort of solid food too soon, particularly such as is highly indigestible. Weak, delicate infants, and those suffering from other diseases, bronchitis, acute infections of any sort, etc., are especially subject to dyspepsia, and the attacks are apt to be severe.

Symptoms.—The prominent symptoms are acute onset with slight elevation of temperature, vomiting, and diarrhea.

They are much the same whether it occurs as a primary condition or complicates some other illness.

Vomiting is usually an early symptom, especially if some gross dietetic error is the cause of the illness. If it is the result of prolonged feeding of too much fat or sugar, the vomiting may appear later, or not at all. It usually comes a considerable time after feeding, and the amount may be very large, apparently representing more than the single feeding. The milk is usually thickly curdled and the vomitus strongly acid. The vomiting is not often of a distressing variety.

The diarrhea consists in large, thin, greenish stools containing curds and usually considerable mucus; there may be from six to eight a day. There is no such typical stool as is associated with weight disturbance; sometimes the stools are brownish and foamy, if the malt preparations have been used; or they may be very watery with large amounts of mucus, and be expelled with the accompaniment of large quantities of gas—be squirted out with considerable force and noise.

The temperature is usually not high, or, if it is, remains so only a few hours. It has no special significance or characteristic.

There is not much tendency to persistent colic in dyspepsia, though there is generally considerable distention with gas with attacks of severe pain. It is passed readily and rarely needs attention after the first day or two. There is great restlessness and these children sleep very little and in severe attacks crying and fretting are nearly constant.

Moderate attacks show nothing else of importance. Severe attacks may be attended with marked pallor, prostration, and considerable loss of weight, and are difficult to differentiate from mild intoxication.

Diagnosis. In the uncomplicated case this is usually made by the history of some indiscretion in diet. When it is the result of the use for some time of too much sugar or fat, or due to decreased resistance because of some other condition, as bronchitis, nasopharyngitis, etc., the diagnosis offers more difficulty. The diarrhea, vomiting, and low temperature,

with considerable abdominal distention, usually make the diagnosis.

Prognosis.—As with weight disturbance, this is not a fatal disease if the proper treatment is at once instituted. Many cases recover perfectly in a few days if they are simply not urged to eat. The danger lies in neglect, continuance of the improper feeding, or too much medication, as the condition may then progress to intoxication, some enteral or parenteral infection may develop, and perhaps marasmus result.

Treatment.—The essential measure is to materially reduce the food, or in severe cases stop it entirely. In most cases, particularly when the attack is an acute one, a cathartic should be given at once to insure a thorough emptying of the intestines; and it is a better plan to do this the first day than to wait a day or two to see if it is going to be necessary. In the cases of slower onset the need is not so evident, and a purge may often be dispensed with. In cases with much elevation of temperature it should always be given. Calomel is best given in broken doses of $\frac{1}{10}$ grain every half-hour or hour, giving 1 or $1\frac{1}{2}$ grains in all. Castor oil is usually not so efficient on account of the tendency to vomit. Either had best be followed by an enema two to six hours later.

Water, barley water or other weak gruel, or weak tea should be given. They are best unsweetened or sweetened with minute amounts of saccharin, $\frac{1}{2}$ grain to a pint. After twelve to twenty-four hours begin with one-quarter skimmed milk in water or gruel, in one-half to two-thirds the amount the child was taking before. The strength of the mixture is increased by one ounce of milk a day, or more rapidly if the condition of the child justifies it. The use of whole milk instead of skimmed milk can be begun in about a week, with the addition of dextrimaltose. Finkelstein strongly recommends the use of albumin milk in this condition, and there is no doubt as to the efficacy of this milk; however, less elaborate means seem to fulfil every indication. If albumin milk is used, it should be remembered that it contains very little sugar, and this must soon be added in small amounts. In very young babies breast milk is of decided value, even

though it contains considerable fat and sugar. It should be begun only after an interval of starvation, the amount should be limited, and it should be slowly increased. With whatever feeding, the interval should be three, or better, four hours.

In weak, delicate infants, or those previously ill, the period of starvation should be short, perhaps only six or eight hours, as it is a very weakening procedure.

With older children the general measures are the same, but the return to the original feeding schedule is usually a matter of only a few days.

A valuable measure in cases where the vomiting is severe and frequent is lavage of the stomach, using warm water or 1 per cent. sodium bicarbonate solution. With babies this is very easily done with a large catheter, and it is usually not necessary more than once. Medicine is best dispensed with in most cases. If the vomiting is persistent, and the lavage not effective, nothing is better than compound chalk mixture, with or without bismuth. If the abdomen is much distended and the pain acute, local application of heat, turpentine stupes, or even mustard plaster, are often of assistance. High rectal irrigation is a very valuable measure, often giving great relief by permitting the escape of gas. Opium in any form is contra-indicated.

INTOXICATION.

(Summer Complaint; Acute Enterocolitis; Cholera Infantum.)

Definition.—This is an acute, febrile disease with sudden onset, vomiting, diarrhea, high fever, and marked prostration. The many names for the condition indicate the obscurity of its causes, the above being only a few of them. It occurs to a very large extent in artificially fed babies, in the hot weather, and is decidedly more common among the poorer, crowded districts of cities.

Etiology.—There is still a great deal of controversy as to the one most important cause, whether it is heat, infection, or food. The most important recent development is the

certainty that imperfect digestion and metabolism of sugar is a potent factor, though the summer heat can hardly be eliminated as at least a predisposing cause. Enteric infection undoubtedly plays a part in many cases, perhaps being subsequent to the intoxication. The facts are that the disease is vastly more frequent in the hot weather, in crowded districts, and with infants fed on artificial food. The younger the baby, the more subject it is to the disease. Weak, delicate infants are naturally more susceptible, and particularly those with some other digestive trouble, as weight disturbance or dyspepsia, or indeed any illness whatever.

The immediate cause of the disease is regarded by Finkelstein as generally due to imperfect metabolism of the sugar; by Czerny to poisonous products formed by the splitting of the fats; by Escherich to direct bacterial infection of the intestinal wall. Milk-sugar can be actually demonstrated as a possible cause of intoxication; this has been done by Finkelstein and Meyer. The fat theory rests on less solid ground. Neither can escape the mass of evidence in favor of infection in many cases, but the number of organisms offered as the cause by different investigators does not sound conclusive. It is certainly a fertile field for investigation. In all probability the disease is primarily due, in the great majority of instances, to faulty diet, digestion, and metabolism; the onset of infection later increases the severity and admits other symptoms. Heat, poor ventilation, weakness, and preceding disease, all lower the child's resistance and favor the onset of intoxication.

Pathology. After death from intoxication the cadaver presents two fairly uniform features—definite changes in the intestinal mucosa and dryness and emaciation of the whole body due to great loss of water. All the tissues seem shrunken, the orbits are wide and hollow, the eyes sunken; the depressed fontanelle, sometimes the overlapping of the cranial bones, the loose, wrinkled skin, in-drawn abdomen, all show the effects of the loss of large amounts of water in the cases lasting a number of days. The intestinal mucosa varies according to the length of illness and the presence or absence of secondary (?) bacterial injury. There may be only

injected vessels surrounded by areas of pallor—the ischemia being the more prominent factor. More definite involvement is shown by infiltration and enlargement of the solitary lymph follicles and Peyer's patches; this gives the studded appearance known as follicular ileocolitis. Still greater injury results in necrosis of the solitary follicles with the formation of very small ulcers. By confluence these form larger, deeper areas and present a similarity to true infectious dysentery. This is the ulcerative ileocolitis, giving the symptom of bloody stools in life.

The kidneys uniformly show cloudy swelling, later fatty degeneration, and occasionally acute glomerular nephritis.

Other lesions, such as congestion of the lungs, etc., are not characteristic.

Symptoms.—The appearance of a baby with a well-advanced case of intoxication is almost pathognomonic. There is apathy or semiconsciousness, rapid, irregular, panting respiration, hollow, staring eyes, pinched, pallid face, and evidences of extreme loss of weight. After having seen a few of these cases one is able to make the diagnosis almost at a glance.

The onset is usually sudden, with a high temperature, 103° to 105° F., or higher. This usually falls rapidly under proper treatment; if it does not, the outlook is very bad. Vomiting and diarrhea occur in the first few hours; vomiting is not constant nor characteristic—it may be very little; diarrhea consists in a great number of watery, mucous stools, containing green lumps, of musty odor, not especially offensive, and, in severe cases of several days' standing, often containing blood. There may be from ten to thirty or more, resulting in great loss of water from the tissues and consequent loss of weight. This effect may be very manifest in twenty-four hours. Mild cases of intoxication may have a diarrhea differing not at all from that of dyspepsia.

The apathy, semi- or complete unconsciousness is one of the most important symptoms. The child lies perfectly quiet and listless, whining only when disturbed and becoming quiet again when let alone. The face, and the eyes especially, are expressionless and no notice is taken of familiar objects.

Of course the more severe the attack and the higher the fever, the more pronounced is this feature. It often progresses to complete collapse, and the condition is then one in which death is apparently imminent.

The respiration has been described by Finkelstein as like that of hunted game. The respiratory excursion deepens with each breath until there is a deep gasp for air; then the shorter inspirations begin again with the same increase and climax. This tendency is noticed even in moderate attacks.

Glycosuria is a constant and early, but transient symptom, the sugar being lactose in the great majority of cases, rarely galactose. This sugar is derived directly from the food and disappears as soon as the food-sugar has all been excreted. Albumin and casts are constantly seen in the early stages, the casts nearly always hyaline. The urine is naturally much reduced in quantity and the specific gravity high.

Leukocytosis is a nearly constant symptom, ranging from 15,000 to 30,000. It is probably both actual and relative, and is of the polynuclear variety.

Nervous symptoms offer a considerable variety. The most important variation is that in which the child presents the symptoms of meningitis, with extreme restlessness, hyperesthesia, rigidity of the limbs and, particularly, of the neck. This condition, well named "meningismus," is extremely misleading.

Convulsions not infrequently usher in the disease or occur during its course. There is no doubt that certain babies have the convulsive tendency to a great extent, and convulsions in this disease do not necessarily mean an attack of great severity. But often they are of grave import, particularly if there are many of them.

Especially significant of danger is a gradual slowing of the pulse, often to 70 or 60 per minute, with muffling of the sounds of the heart or perhaps only one audible sound at the apex; also a very weak, plaintive cry when the child is disturbed; and a marked flabbiness and laxity of all the muscles.

Diagnosis.—Little can be added as to points in diagnosis. Of the usual symptoms, all are nearly constantly present, the

only considerable variation being in the nervous symptoms. Most important are change in consciousness, rapid loss of weight, respiration, fever, and diarrhea. Of importance in the diagnosis is the very rapid improvement which usually occurs with proper treatment when the case is seen early.

Prognosis.— From the very great number of deaths from this disease one would think the prognosis very unfavorable. This is not the case in previously healthy children who receive proper treatment at the onset of the disease; such cases should recover. If the child has been poorly or improperly nourished, or has been previously ill, the chances are much less; if the diseases has been allowed to run several days without treatment, the outlook is extremely bad. Continued high fever is a very bad sign.

Treatment.— Preventive measures offer one of the greatest fields in medicine. Unfortunately these measures include so many things: better housing, less crowding, education in proper infant feeding, cleanliness, etc., that the physician can do little toward it. Much is being done, particularly in regard to a good milk supply, insisting on fewer clothes for little babies in the hot weather, and giving many hours in the open air protected from the sun. One should be very cautious about increasing the amount or the variety of a child's food in the hot weather; and particularly guard against any unusual, unnecessary food.

Actual treatment consists in at once stopping any and all food for from twelve to twenty-four hours, according to the strength of the infant. This is an imperative measure but must nevertheless be used with caution on weak babies, and nourishment begun before the weakness has become extreme. On no point is nicer judgment needed. The next necessity is to supply water. Water alone may be given during the starvation period, and is the safest plan if the baby will take enough of it (from one to two pints a day); weak tea may be given sweetened with saccharin, half a grain to a pint, or weak barley water, sweetened in the same way if necessary. Prompt reduction in the temperature is the effect desired; as soon as this occurs other food can be given; if it continues the second day, continue the starvation *if the child's condition warrants it.*

When food is begun, it should be in very small quantities at first, and should be as nearly as possible free from sugar and also contain very little fat. Many foods have been prepared to meet this indication, the best known being Finkelstein's eiweissmilch (albumin-milk). The success of this preparation in the treatment of intoxication is remarkable, but Finkelstein himself no longer advises the use of such a low percentage of sugar for more than two or three days. It should be begun with feedings of an ounce every three hours to a very young baby, and increased daily as it is indicated. Water must be given *ad libitum* between feedings. Constant improvement in the stools and the general condition are the guide to increase in the food. Sugar, preferably maltose or dextrimaltose, is added as rapidly as the symptoms permit. On account of the difficulty of preparing albumin milk in the home, it is necessary to use other forms of food in general home treatment. Skimmed milk, buttermilk, or separated curds mixed with thin barley water, sweetened with saccharin if necessary, are all beneficial. In fact, if treatment is begun early, the results with skimmed milk are as good as with any other food. Whatever food is used, it is best always to add the sugar in the form of maltose or dextrimaltose, as they are better borne than any other.

Replacing the large amounts of water lost sometimes offers great difficulty. If the child will not take or retain it in sufficient amounts, it must be given by rectum or by hypodermoclysis, as described in a previous chapter. The beneficial results of this are sometimes striking and immediate.

Infants over a year old can usually be given one-half skimmed milk after the starvation period, diluted with water or barley water. From thirty to thirty-five ounces is usually sufficient to keep up the strength. To this starch or sugar is gradually added, and in a few days the use of whole milk is possible. After the first week or so vegetable gruels can be instituted with cracker and toast or crust. From this to a regular diet is a matter of gradual increase, depending on the diet preceding the illness.

The use of egg and water has a place in the treatment of this affection, but it is best used only as an aid to the other food

and to give a slight variety when it seems advisable. Refusal to take other food may be an indication for its use.

Most of these babies will improve very rapidly on breast milk after the acute symptoms have subsided. Finkelstein advises the use of centrifuged breast milk in difficult cases.

Other Treatment.—Medicinal measures have little place in this disease. A dose of castor oil or calomel in the beginning seems a rational and safe procedure. Many pediatrists consider it needless, as the diarrhea is already pronounced, and the effect of the cathartic may be weakening. But it seems wiser to give it in the beginning rather than wait for the more definite indications, *i. e.*, continued fever and persisting symptoms. It is very true that many cases recover promptly by proper dietetic treatment alone. If the fever continues and the symptoms do not subside on the proper diet, it may be well to repeat the calomel or oil. There is often no need of remedies to improve the stools and lessen the number. This improvement should follow the proper treatment as regards the food; if it does not, bismuth, salicylates, etc., may be of benefit—and they may not. There is little likelihood that they will do any harm. Daily irrigations of the colon do seem to have a good effect if the diarrhea is persistent. This is particularly true if the temperature also remains high. It is here that the value of cultures of the lactic acid bacillus are recommended. Excellent results have been reported, and as frequently denied, following the use of tablets containing the living bacillus. Each contains about 6000 bacilli and are to be given from four to eight or more every day for a week; they are said to destroy the harmful bacilli by forming an acid medium in which they cannot live. A certain amount of sugar must be given with them to permit the formation of lactic acid.

With persistant, weakening diarrhea it may be necessary to resort to the cautious use of opium.

For the high temperature it is advisable to use no other measures than the application of cold, either the ice-cap, cool bath, or cool irrigations of the colon. This often helps the nervousness and restlessness.

The value of any sort of stimulation in the cases of collapse

is doubtful. Warmth, counter-irritation with mustard, or rubbing briskly with alcohol seem sometimes beneficial. Of stimulants, brandy is probably the most efficacious if it does not upset the stomach. Strychnine, camphor and caffeine may all be tried; all can be given hypodermically.

The nervous symptoms must be met by the use of bromides, chloral, or cautious use of the coal-tar sedatives. They are very effective when given by rectum, and it is well to use them in small doses for unusual restlessness before more severe symptoms occur.

MARASMUS.

(Infantile Atrophy; Decomposition.)

Definition.—This is an advanced stage of malnutrition without acute symptoms, in which the powers of digestion and absorption are extremely low; it is characterized by progressive loss of weight, subnormal temperature, greatly lessened resistance, and finally extreme emaciation and weakness. It may fairly be compared to the condition of premature babies of twenty-eight weeks' gestation.

Etiology.—The most important causes of marasmus are improper artificial food, crowded quarters with poor air, antecedent illness, and, particularly, confinement in institutions where many babies are cared for. The two former and the last are of vastly greater importance than any other item. Conditions similar to it are caused by tuberculosis, syphilis, and other chronic diseases; they will be considered under their headings.

In the great majority of cases this occurs in the first few months of life. It is very frequent in baby hospitals and asylums, among the very poor, and is seen with comparative rarity in private practice. When it occurs as a purely nutritional disturbance, it is probably always due to some preceding digestive or nutritional disorder, as intoxication, recurring dyspepsia, and intractable weight disturbance. It may follow any severe infectious disease.

Most cases are due to the feeding of proprietary foods, and are consequently due to a high carbohydrate content; the

fewer cases in which the trouble can be traced to fat or proteid is probably due to the fact that very many less infants are fed on a food containing a large percentage of fat or proteid.

Pathology. The absence of any marked pathological change in any of the organs is now conceded. The belief in a condition of atrophy of the gastro-intestinal mucosa is proved erroneous, and is admitted by Finkelstein to be unfounded. Nothing is observed postmortem except the extreme emaciation.

Symptoms. These may be well illustrated by first comparing them with those of intoxication, to which they present diametrical opposition. In the early stage there are perfect consciousness, irritability, subnormal temperature, slow

FIG. 4.—Marasmus. The constant sucking of the hands evidences the hunger that cannot safely be satisfied. (St. Louis Children's Hospital.)

pulse, quiet but irregular breathing, normal urine, and stools of almost any variety; intoxication presents dull apathy or unconsciousness, no irritability, high temperature, rapid pulse, deep, panting respiration, sugar, casts and albumin in a concentrated urine, and distressing diarrhea.

The onset of marasmus is so obscure that its existence is difficult to determine in the beginning, and making a diagnosis is a matter of careful observation for many days. It can only be decided when there is progressive loss of weight with intolerance to any sort of food in sufficient amount to make a gain possible. With this are associated the symptoms enumerated above.

The progress of the disease results in such extreme emacia-

tion that these babies have been described as "ape-like;" the pinched face, hollow eyes, skin drawn over the bones, etc., progressing to an almost unbelievable state of shrivelling. There is nothing characteristic about the stools; there is usually moderate diarrhea, rarely distressing, with fat stools, soap stools, or loose, slimy and very offensive; they may differ little from normal.

These babies are nearly always greedy for any sort of food and suck the fists and give other evidences of hunger nearly constantly. To this the great irritability is doubtless due. The subnormal temperature is practically a constant symptom, as is the slow pulse. The absence of other symptoms must be considered in the diagnosis. Edema of legs, arms and body often occurs, making a noticeable and deceptive gain in weight.

Treatment.—A discussion of treatment necessitates a survey of the object to be accomplished, *i. e.*, a gain in weight and strength. In no other condition is there such a need of appreciating the possibilities of the infant's digestion. Here there is an obstinate intolerance for sufficient food to make an increase in the weight; in many cases the tolerance is so low that not enough food can be given to keep the child from losing; such cases, of course, inevitably starve to death. The problem, then, is to give food in sufficient amount at first so the weight is maintained—nothing further should be attempted. With an improvement of the general condition the food must be increased with the greatest care. Any attempt to hurry a case of marasmus on the way to recovery is sure to invite disaster.

Without any qualification the best food for a marantic baby is human milk. The value of this is so great that even two feedings a day, combined with other proper feeding, often is the means of saving the life, when nothing else would. In severe cases it must be used with caution, as given in detail later.

With artificial feeding it is needful to know that fat is usually tolerated in very small amounts (often not at all), the sugars somewhat better, malt-sugar best, and the amount of the feeding must absolutely be reduced to a minimum by

which loss of weight is prevented and no gain expected. We must therefore depend on some food in which the albumin is the chief element. This is supplied in skimmed milk or buttermilk, diluted with thin gruel. Of course these babies cannot endure any sort of a starvation period, and this should never be attempted.

Skimmed milk or buttermilk, then, is given at three- or four-hour intervals so that a value of about 70 calories per kilogram is maintained. The first few days it must usually be much less than this. It is well to begin giving the milk about one and a half ounces for each pound of weight; ordinary skimmed milk contains about 12 calories per ounce, and this would be only about 40 calories per kilogram. As the child shows no disturbance on this food, it should be increased every day by one-quarter or one-half an ounce at each feeding until the weight ceases to decline. It is best to keep the child on food which will cause a general improvement in conditions, but no gain in weight, for two or three weeks. Even then increase must be made gradually and the child carefully observed. Always the baby must be permitted to take all the water it will, sweetened with saccharin if necessary. Malt-sugar should be begun in small amounts by the third or fourth day, in mild cases on the second day. It is best to use only one teaspoonful in the whole mixture the first day, increasing one teaspoonful each day, as the baby tolerates it, until the milk contains about 4 per cent. Later additions are entirely a matter of individual need. By this time (two or three weeks perhaps) fat must be added. This is best done by adding one teaspoonful of gravity cream to the total twenty-four-hour quantity. It can be increased a teaspoonful daily, the utmost care being exercised to detect any evidence of fat indigestion. When the child is showing a slow, consistent gain, it is best to keep the fat at that percentage for an indefinite period, until evidences of hunger, and restlessness, with normal stools, show the need for a greater amount. We are never safe in taking any liberties with the digestion until three months of improvement have passed. At any sign of fat or sugar indigestion the amount of both should be reduced or cut out, later being begun with even greater caution. The slightest

overfeeding will usually result in the so-called "paradox reaction."

The use of breast milk is subject to the same limitations, if the supply is ample. The baby should nurse only from two to four minutes, according to the vigor with which it nurses, and at intervals of three hours. This is gradually increased as in the artificial feeding. With infants far advanced in marasmus it may be advisable to use centrifuged breast milk, removing the fat.

The use of albumin milk has been attended with great success in the work of Finkelstein, and others after him. The rarity of this disease in private practice, and the practical impossibility of making this milk in the homes in these cases, render its discussion here rather out of place. Its use in institutions is certainly worth while. The same caution in regard to its use, and the necessity for the early addition of malt-sugar, must be exercised as in the other milk feeding.

Other Treatment.—One should bear constantly in mind the extreme susceptibility of these infants to cold, to high temperature, and to infection of any sort, intestinal, respiratory, skin, etc. Also the imperative need for fresh air and being "played with," carried about, interested, anything but kept lying in the same place in the same position. Although it is an easy matter to overdo the handling of such infants, it is also a mistake to leave them too much alone.

The use of medicines has no place in the treatment of this condition. An infant in need of stimulants is in a state of collapse that is hopeless if it does not respond to heat, counter-irritation, etc. The value of whisky, strychnine, caffeine and camphor is very doubtful, but they can be used as a last resort.

The presence of edema is a bad sign. Lessening the salts in the food (using albumin milk) sometimes results very favorably in reducing the edema, but with it there is usually marked anemia which will not permit using a very low food value.

INFANTILE SCURVY.

Definition.—This disease, called also scorbutus, is a nutritional disorder due to the prolonged use of unsuitable food.

It is characterized by hemorrhage in various localities, especially under the periosteum of the long bones, with evidences of malnutrition.

Etiology.—That scurvy is due to the prolonged use of food lacking in some element which is essential to normal growth and development is practically certain. The nature of this deficiency is obscure. The nearest approach to a reasonable explanation is that of Funk, who attributes the disturbance to a lack of vital substances which he calls vitamins. These he considers amino-acid bodies contained in raw animal and vegetable products, particularly in the cortex of rice, corn, and other grains; these grains produce beri-beri, pellagra, etc., only when they have been deprived of the cortex by polishing or by improper handling. Scurvy is due to the same lack, caused by prolonged boiling of the food, which destroys the vitamins; or giving artificial food which does not contain these substances; or giving some presumably proper food which is for some reason defective in this particular, as cows' milk or, rarely, human milk. Many experiments, much good reasoning, and the collection of a multitude of observations, make this assumption the most rational that has been put forward as the cause of scurvy. For further details the articles of Funk should be read.

Artificial food deficient in some particular, used for a period of many months, is practically always the cause of scurvy. A few cases occur in breast-fed infants, usually those nursed much longer than a year. The controversy as to which particular food is most likely to cause it is still being waged. But in every series of cases reported there is always a considerable number due to the use of boiled cows' milk. Prolonged use of sterilized milk, particularly that which has been heated for a long time, must be considered a probable cause. Any sort of artificial food may be responsible, or even, in rare instances, breast milk. Unless we accept the conclusions of Funk, there is no special food or substance that can be blamed. The proprietary foods, condensed milk, and sterilized milk seem to have most cases assigned to them.

The disease occurs much more frequently between six

and sixteen months of age; it is rare before six months, much more rare after eighteen; typical cases are seen up to four years. It occurs in the country as often as the city, and among the babies of the better class of people rather more frequently.

Pathology.—The constant lesion is hemorrhage, commonly under the periosteum of the long bones and from the gums about the teeth; it may be seen in any of the internal organs, skin, or serous surfaces. The cortex of the bone is thin, brittle, and near the epiphyseal line the bone is less dense; this is particularly the case at the anterior ends of the ribs and the ends of the long bones of the limbs; here it is responsible for frequent separations of the epiphyses.

The tendency to hemorrhage is found to be due to a weakness of the vessel walls rather than to any change in the coagulability of the blood itself; and this is not confined to scurvy, as other diseases show the tendency. The frequent location under the periosteum is characteristic of scurvy.

Symptoms.—In the early stages the only symptoms of any value in diagnosis are tenderness and lack of motion of the legs, swollen, spongy, easily bleeding gums, and anemia. In many cases there are preceding evidences of poor nutrition, as pallor, fretfulness, and loss of weight, but they are of minor importance, and may not be specially evident in the beginning.

As the disease progresses the child becomes cross, fretful, pallid, sleeps poorly, loses weight, and is evidently seriously ill. With the progress of the disease the pain and tenderness of the legs increase, the child lying perfectly still, but screaming with pain at any attempts to handle it; the tenderness may be in both arms and both legs, simulating a complete paralysis. Often the posture is a characteristic one, the legs and thighs being slightly flexed, and the thighs rotated outward. If the arms are affected, they rest extended outward in a limp manner. The child will lie constantly in this position, and the tenderness is sometimes so great that the least movement, or the approach of anyone, causes the child to scream. The tenderness is most often in the knees and ankles, but may be over any point of the arms or legs, rarely elsewhere.

If the extremities are carefully examined there will usually be found one or more fusiform swellings. These swellings, which are due to the subperiosteal hemorrhages, are most frequent and most marked near the joints; in the great majority of cases the location is the lower part of the thigh, or lower part of the leg. Much less often they are seen at the hip, elbow or wrist; rarely the sternum, scapula or ribs. Sometimes the bleeding is of great extent and may extend the entire length of the bone. In very severe cases there is apt to be a separation of one or more epiphyses of the long bones. Sometimes there is a purplish hue to the skin over the hemorrhage; reddening of the area is quite rare.

In the great majority of the cases the gums are affected at the same time. They are swollen, spongy, and bleed easily. Ulcerative stomatitis sometimes develops, but never unless the teeth have erupted. When the teeth have not erupted, the gums may show involvement, but much less constantly. In mild cases the gums about the upper incisors are often the only ones affected.

Purpuric spots on the skin are present in many of the severe cases, being due to small hemorrhages under the skin. They are usually multiple, never very extensive, and apparently most often occur in localities where they may be caused by light bruising.

Hematuria is common, but seems not a particularly unfavorable sign. Rarely bleeding occurs from other sources, as the nose and intestines.

The temperature is usually normal.

Diagnosis.—Scurvy must be considered in every baby with enlargement and tenderness of the joints. It is most often mistaken for rheumatism. Here the age, the normal temperature, with the feeding history will serve to differentiate; if one thinks to look at the gums he will usually make the diagnosis, but he must have scurvy in mind in order to do this; and when scurvy is thought of, the diagnosis is usually made at once.

The paralysis simulates poliomyelitis, luetic epiphysitis, or other paralysis. The exquisite tenderness should prevent error here. Osteomyelitis is usually confined to one bone,

and the fever and the constitutional symptoms and leukocyte count should suffice to rule it out.

The frequent association of rickets may sometimes be helpful as a diagnostic sign. It has been noted in nearly half the cases of scurvy.

Prognosis.—This is good. Recovery will be rapid under proper treatment, even though very far advanced. Deaths reported from it are very rare. When it occurs associated with some other condition, as a severe gastro-intestinal disorder, the outlook is naturally not so favorable. Recovery from the malnutrition with which it is often associated may be prolonged.

Treatment.—The child should be handled as little as possible on account of the severe pain it causes. If there is separation of an epiphysis, the limb should be properly set in splints. A mild antiseptic mouth wash should be used carefully to prevent the occurrence of ulcerative stomatitis.

A cure is regularly the result of proper diet. The food that has caused the condition should be discontinued, no matter what it has been. Most cases will recover perfectly if put on raw cows' milk, properly modified. Orange-juice will hasten the recovery. The rapidity of improvement, the relief of symptoms, etc., that follow this procedure is strikingly characteristic of scurvy; in no other disease is there such a simple, effective and rapid therapy. Usually the symptoms have subsided in three or four days, and a cure results in two to four weeks.

Other articles of diet are beef-juice and potato soup; the value of potato is very great. Older children should be given potato and a variety of green vegetables and fresh fruits.

Often there is manifest malnutrition after the child has recovered from the scurvy. This is best treated by fresh air, iron, cod-liver oil, and a carefully regulated, wholesome diet.

RICKETS.

(Rachitis.)

Definition.—This is a chronic constitutional disease due to imperfect nutrition. It is characterized by enlargement

of the epiphyses of the long bones, softening of the bones, and by general evidences of malnutrition of the whole body.

Etiology. The circumstances under which the great majority of cases of rickets occur lead strongly to the belief that the cause lies in some fault in the food. It is far more frequent in the cities, among the poorer classes, and the artificially fed, particularly in babies fed on sweetened condensed milk and other proprietary foods containing largely carbohydrates. This means, of course, a food deficient in proteid and fat. Investigations apparently show the relative unimportance of the low proteid, and this confirms the growing belief in the importance of very low fat content as the principal cause of rickets as far as the food is concerned. Other factors are of importance, as in most other nutritional disturbances; poor air, poor surroundings, previous ill health, delicacy from heredity or any other cause. Children fed on the breast frequently develop rickets if the nursing is prolonged much after the first year. And the condition is so frequent among negroes, however fed, that in a large clinic in the city one comes to look for it almost as a matter of course. This is unaccountable from the stand-point of any feeding theory, but must be due to some deficiency in the breast milk. The theories of infection, of faulty calcium metabolism, and heredity, etc., have comparatively little evidence in their favor.

The disease is nearly always observed from six to eighteen months, actual development being rare either earlier or later.

Pathology.—Although all the tissues of the body are affected by the malnutrition, the only changes characteristic of rickets occur in the bones. Of visceral lesions none are characteristic; there is a constant enlargement of the spleen, due to simple hyperplasia; the liver is frequently enlarged; the lungs show grooves due to the sunken chest wall when that deformity is present, and very frequently bronchitis and bronchopneumonia; other changes, such as gastro-intestinal catarrh, anemia of the muscles, enlarged lymph glands, are such as frequently occur in other chronic conditions.

The bones show constant gross and microscopic changes.

These take place in the part of the bone where ossification is in progress, that is, in the cartilage between the epiphysis and the shaft at the ends of the long bones; in the layer of periosteum next the bone; and in the flat bones at the centres of ossification. Normally the bones grow by proliferation of the cartilage cells in these localities; the deposition of lime salts in these cells transforms them into bone cells, the tissue thus undergoing ossification. In rickets the proliferation of these cartilage cells is stimulated to undue activity, while the deposit of lime salts does not keep pace with the cartilaginous growth. The result of these abnormal changes is a marked enlargement of the epiphyses of the long bones and the ossification centres of the flat bones, and a softening of the bones everywhere. The softness and flexibility of the bones is due to the deficiency of lime salts, the normal two-thirds of mineral matter being reduced sometimes to only one-third. It is to this that the rachitic deformities are due; they occur oftener in certain sites because of the greater muscular strain to which they are subjected in certain localities, as the femur, tibia, radius, or the ribs.

A section through the epiphyseal junction of a rachitic bone presents a bluish color, due to the large amount of cartilage, and a greatly increased vascularity; the tissue is soft and cuts more easily than normal. In the portion of the shaft of the bone next to the periosteum much the same condition exists, but toward the medullary canal it becomes more dense, and the inner layer is thin and unusually dense; this explains the brittle character of rachitic bones and the ease with which the shafts are broken. Section through the thickened places on the flat bones shows the same sort of spongy, vascular substance which is soft enough to be indented easily.

Microscopic examination shows a marked increase of new cartilage cells and increased vascularity of the proliferating zone. Areas that should be calcified show large quantities of cartilaginous tissue instead. The under layer of the periosteum is thickened, very vascular, and there is a great excess of uncalcified cartilage. In the flat bones the con-

dition is similar, but here the bony trabeculæ are eroded and the spaces filled with bloodvessels and a connective tissue very rich in cells.

These changes are undoubtedly similar to those caused by a chronic, mild inflammatory process, and have been in a great measure responsible for the theory of the infectious nature of rickets.

When the rachitic process ceases and recovery begins, this excessive proliferation stops. Calcification and ossification of these tissues take place, the enlargements due to the hyperplasia are absorbed, leaving the condition nearly normal except that the resulting bone is apt to be even harder than normal. Many of the deformities also voluntarily straighten.

Symptoms.—Rickets is essentially a disease of very slow, gradual onset and progression. It is difficult to say when it begins, as the early symptoms are not such as to direct attention to rickets as the cause. A fully developed case is easily recognized; but it is of much greater value, of course, to be able to make a diagnosis in the beginning, and prevent its further development.

The most constant early symptoms are anemia, sweating of the head (especially during sleep), marked restlessness at night, slight beading of the ribs, craniotabes, and constipation. The restlessness is sometimes so great that these children rub all the hair off the back of the head by constant tossing about. The sweating of the head and neck is extreme, often making a damp place on the pillow several inches about the head.

As the disease advances the bone changes become more prominent, although the other symptoms continue. The beading of the ribs, at the costochrondral junction, increases until the little lumps are evident to the eye, and form the so-called "rachitic rosary," though in the early stages they are evident only by palpation. These "beads" are due to the characteristic overgrowth of cartilage, and one is located at the junction of each rib with its costal cartilage, thus forming a row of them running downward and outward to the costal margin. The same beading is found on the inner side of the thorax, and may be seen definitely post-mortem even when the beading on the outside is very slight.

Another change in the ribs, in advanced cases, is a depression or groove extending in a horizontal direction around the lower portion of the thorax; it is probably due to the pulling of

FIG. 5.—Characteristic deformities of legs in rickets. The enlargements of the ankles and the wrist of one child can be seen. (St. Louis Children's Hospital.)

the diaphragm on the softened ribs. Another deformity, due also to muscular action and atmospheric pressure, is a marked depression of the thorax in a vertical direction on either side of the sternum, at the costochondral junction,

and following, therefore, the course of the rosary. The deformity known as "pigeon breast" probably exists only when some respiratory obstruction complicates rickets; it is not typical of rickets.

The changes in the cranium are well marked and characteristic. The head appears large and square, the forehead broad and projecting, the top is flattened and the suggestion of two furrows crossing each other at right angles at the anterior fontanelle is often present. These appearances are due to round, symmetrical, thickened masses of bone, called "bosses," which develop on the frontal and parietal eminences; these bosses often grow quite prominent.

In the occipitoparietal regions there are frequently found soft spots in the bones, generally in the early stages of the disease. They are from one-half to one inch in diameter, usually multiple, and on pressure with the finger they bend in, suddenly springing out again when the pressure is discontinued. This condition is known as craniotabes. It is seen occasionally in syphilis, but less often than in rickets.

The sutures are late in closing, as are the fontanelles; often the sagittal suture is open at the end of a year, and the anterior fontanelle at the end of the second or even the third year. The veins of the scalp are large, and can readily be outlined through the skin.

Changes in the long bones of the limbs are seen early and constantly. The earliest is a rounded, knob-like enlargement, found at the epiphyseal junctions. The wrists and ankles show this change most frequently, the knees and elbows less often. The shoulders may show it in the most severe cases. The long bones also show deformities due to bending of the shafts; this may be slight in degree and readily overcome, or the bending may be so extreme as to render the limbs almost useless.

These deformities are most prominent in the legs, to a less extent in the arms and thighs. In the legs the usual variety is an outward bowing of the tibiæ, producing the deformity known as bow-legs, or genu varum. In these children, when the feet are put together, the knees are far apart. In others the opposite condition of knock-knee, or genu valgum, is

present. In this the feet are widely separated when the knees are put together, and it is presumed to be due to an overgrowth of the inner condyles of the femora. In very severe cases the softening of the bones is so extreme that irregular and very distressing deformities are produced by the posture in which the limbs are habitually held, the legs or arms bending from the continual slight pressure. In the forearm the bones are usually bowed backward, in the upper arm outward.

Fig. 6.—Rickets. Showing the box-head, prominent abdomen, enlarged epiphyses, and deformed legs and arms. (Dr. Nathaniel Allison.)

The vertebræ are also partially softened, and the weight of the head and shoulders, combined with the weakness of the muscles that hold the body erect, causes a posterior or lateral bending of the spinal column. The kyphosis so produced forms a long, regular curve in the lumbar and lower dorsal region. Scoliosis, or lateral curvature, is more rare and is of

the same character; marked curvature of the spine in infants is usually due to rickets. In the early stages these curvatures disappear when the child lies down or hangs suspended. But in the long-standing cases they persist and may be difficult to correct.

The teeth are cut quite late, are often irregular in making their appearance, and are subject to early decay. The various disturbances connected with dentition are more apt to be seen in rachitic than in normal children.

In the pelvic bones rickets causes certain changes that are of importance from the obstetrical stand-point, since the deformity may after maturity interfere with, or prevent, the passage of the baby through the female pelvis. The usual deformity is a decided shortening of the anteroposterior diameter, due to pushing forward of the sacrum.

The ligaments about all the joints are weakened and relaxed, thus assisting in the production of deformities. Over-extension at the knees, with a resulting prominence of the popliteal areas, is the commonest effect. The muscles are small, flabby and feeble, so that sitting and standing are difficult for these children. Walking is always learned late, and very frequently the children are first brought to the physician because they cannot walk months after they should have learned; the parents usually fear it is due to paralysis.

Children with early rickets are oftener fat than thin, but they are always anemic, and the muscles soft and flabby; the later they are seen, the more likely are they to show decided evidence of malnutrition, and they often then are thin and undernourished. The abdomen is large and tympanitic, sometimes being extremely prominent. This is due to loss of tone of the abdominal muscles and of the musculature of the intestinal walls, causing distention of the stomach and intestines; in case of marked deformity of the chest the pushing down of the diaphragm may assist in the distention. The spleen can generally be felt.

There is no fever associated with rickets. Pulse and respiration are normal, as is the urine.

Rachitic children are quite prone to catarrhal inflammation of the gastro-intestinal tract and the respiratory tract. The

reflex excitability of the nervous system is much exaggerated, and restlessness, laryngysmus stridulus, tetany, and convulsions are frequent. The convulsions usually occur during some digestive disturbance, and the general spasmophilic tendency is doubtless due to some metabolic error other than the one causing the rickets.

Diagnosis.—In a well-developed case the diagnosis is not difficult. Hydrocephalus is the only disease with which it is likely to be confused, but in a case where such marked changes have occurred in the head there are always the many other signs of rickets found by careful examination.

In the early or mild cases the sweating of the head, great restlessness, delayed dentition, large fontanelle, and the enlargement at the wrists, ankles, and costal cartilages are sufficient to establish the existence of rickets. One should always think of this disease when a child is brought to him because it makes no attempt to walk after a year old.

Prognosis.—The disease is never the direct cause of death, and will recover spontaneously when the diet becomes such as to furnish the proper nutrition. But the general weakness and lack of resistance to disease that these children exhibit makes rickets a large factor in determining the death-rate from gastro-intestinal, respiratory, and infectious diseases of any sort.

The extreme bony deformities must often be corrected by operation: some of them cannot be corrected and remain throughout life. The milder ones usually correct themselves to a great extent.

Treatment.—As usual with nutritional diseases, the prime indication is to prevent the disease by proper diet and hygiene. And the treatment must follow the same lines. An early diagnosis is essential, as the severe cases can only be prevented by early treatment, and much harm may have been done without the baby appearing to be at all ill.

Children with rickets should be kept in cool, dry, well-ventilated rooms or in the open air. They should have as much out-of-door life as possible, and particularly plenty of sunshine. Each day they should be given a cool bath to stimulate the respiration and circulation, and to accustom the

body to sudden changes in temperature, thus doing away with the tendency to "catch cold."

The food on which the child has developed the disease must be discontinued. In giving the proper food, allowance must be made for the poor development of the child's digestion, which is usually much less than that of a normal child of the same age. For a young infant breast milk should be procured if possible. Artificial feeding should aim to give fat and proteid in considerable amount, diminishing the carbohydrates. For babies this will mean modified cows' milk. At the age of a year beef-juice, egg, fruit-juice, scraped beef and cream or olive oil fulfill the conditions admirably.

As regards drugs, the most rational mixture, and the only one that apparently has any beneficial effect, is phosphorus and cod-liver oil. In some obscure way cod-liver oil aids in the retention by the body of both calcium and phosphorus, both of which are deficient in the bones in rickets. Calcium is practically always present in the food in sufficient amount; certainly it is when cows' milk is the food. Phosphorus had best be supplied. Therefore it is well to give cod-liver oil, a dessertspoonful, two or three times a day, and combine with it sufficient phosphorus (oleum phosphorati) to make a dose of from $\frac{1}{200}$ to $\frac{1}{100}$ of a grain.

Constipation is treated along the general lines laid down in a former chapter. There is no special indication. If it seems advisable, iron should be given for the anemia; usually the anemia disappears promptly on the proper diet, and the use of iron had best be dispensed with if the constipation is obstinate.

During the active stage of the disease attention should be given to the prevention of bony deformities as far as possible; any postural habit, such as sitting cross-legged, sitting upright without support, should be discouraged; walking should not be permitted. When it is evident that there is some bending of the bones, light supports and braces may be used with advantage.

Marked deformities require the employment of orthopedic apparatus or operation. In the case of the legs and arms, osteotomy is the preferable procedure, and it should be de-

layed until the third or fourth year when the bones have become sufficiently firm. Deformities of the chest offer slight hope of correction. Proper, regulated gymnastics are of great value.

SPASMOPHILIA.

Definition.—This is a condition characterized by increased irritability of the somatic nerves with a tendency to constant or intermittent spasm of one or more groups of muscles. Some of these spasmodic states are so characteristic that they have been called by names that designate them in particular, *i. e.*, laryngismus stridulus (laryngeal spasm), carpopedal spasm, eclampsia.

Etiology.—That spasmophilia is a disorder of nutrition is assumed from its occurrence almost exclusively in artificially fed infants, and particularly in those who have been poorly nourished. It is most common from four to twelve months, much more frequent in boy babies than girls, and is nearly always associated with some marked nutritional disorder, especially rickets. In older children it is rare, and usually follows some severe, prolonged illness. In both children and adults it always follows surgical removal of the parathyroid glands. Exciting causes in those predisposed to the disease are any sort of acute illness or exposure, most often acute disorders of the intestinal tract.

Nothing is known as to the primary cause of the disease. The importance of the parathyroids diminishes when it is found that most cases show no abnormality of these glands postmortem. Experiments with calcium have shown as much evidence that the fault is too little calcium as too much, according to who does the experimenting. Probably there is some fault with the calcium metabolism, but we know almost nothing about what the fault is.

Pathology.—There is no distinctive pathology except in those cases that show gross lesions of the parathyroid glands; only a small minority show these changes.

Symptoms.—The ones that usually attract attention are the spasms of one sort or another. They are carpopedal spasm, laryngospasm, and general convulsions.

Carpopedal spasm, generally called tetany, is the commonest symptom. It is a state of continuous spasm of the muscles of the hands and feet resulting in a characteristic

FIG. 7.—Spasmophilia. Hands show the typical spasm of tetany. The feet do not show the typical spasmodic contraction. (St. Louis Children's Hospital.)

position of these members. The forearm is bent at the elbow, the wrist flexed, the fingers and thumb flexed at the metacarpophalangeal joints and the fingers themselves held straight, with the thumb strongly adducted. This results in the

so-called "obstetrical hand," it being the position taken by the hand in forcibly dilating the cervix uteri. The feet are strongly extended, the toes flexed at the metatarsal articulation and straight beyond; the dorsum of the foot stands out prominently, and the position of the whole foot is that of talipes equino varus. In marked cases the adductors of the upper arms and thighs are affected. Rarely the muscles of the trunk and face are in contraction.

Laryngospasm is much more rare than the above; usually carpopedal spasm is associated with it. The attack is of short duration and at first may be so slight that it escapes attention. It comes on suddenly. The child throws back its head, respiration stops, the face becomes pale and later livid. There is evident distress, the child making greater efforts to breathe, cyanosis develops, and the child may become limp and almost lifeless. After a few seconds, or perhaps a minute, the spasm of the glottis relaxes and long, deep inspirations begin, producing a crowing sound. The attacks may prove fatal; not infrequently they result in unconsciousness or in general convulsions. There may be many mild attacks every day for a considerable period of time; severe ones do not occur so frequently in the same child. If convulsions occur frequently with the attacks, the outlook is bad.

Convulsions in this disease are of the same nature as general convulsions occurring in any other condition; they are not at all distinctive of spasmophilia, but children with this diathesis are extremely subject to them. In general it may be said that children with spasmophilia who have frequent convulsions offer a poor prognosis. They will be taken up in detail under another heading.

The most interesting symptoms of this condition are those that are elicited only by careful examination. They are typical of this disease and are due, as all the symptoms are, to nerve irritability. They should be looked for in every case of chronic disturbed nutrition. Chvostek's sign is present in every case of marked spasmophilia. It consists in a sharp contraction of the small muscles of the side of the mouth, nose and eye when the seventh nerve is tapped lightly at its exit from the

parotid gland. Sometimes a slight tap anywhere in that area will elicit the contraction. In mild cases the muscles of the eyelids or lip alone contract.

Trousseau's sign consists in the production of the typical carpal spasm by constricting the upper arm enough to stop the blood flow for a minute or more. This sign is not nearly so constant as the former, but when present it is absolutely diagnostic.

Recently it has been demonstrated that the electrical irritability of the muscles is so great that the spasmophilic diathesis can be determined in very early cases by ascertaining the number of milliampères of current necessary to cause a contraction of the muscle. This requires, of course, a delicate instrument, and in general it need only be said that the minimum current which will cause the normal muscle to contract is five milliampères for the anodal opening reaction. Consistent contraction with a less current is nearly conclusive evidence of spasmophilia.

Other symptoms are such as may occur in any condition of chronic malnutrition, *i. e.*, anemia, fretfulness, intestinal disturbances, etc.

Diagnosis.—There is no difficulty whatever about the diagnosis in cases showing the typical muscular spasms; they are self-evident. Less severe cases can only be recognized if one has the disease in mind in every case of malnutrition in infants. Chvostek's sign is very easily elicited and makes the diagnosis if it is present. The cases which show nothing but the increased electrical irritability will be discovered only by routine examinations with the electrical instrument.

Prognosis.—This is the same as that of the state of general nutrition. It is rarely the cause of death. Weak babies who develop general convulsions do not often recover, and the convulsive state itself may prove fatal.

Treatment.—For the cure of the condition itself attention must be paid to the underlying nutritional disturbance, which is usually rickets. Younger infants will show improvement quickest on breast milk, whatever the nutritional disturbance. Outdoor life, good sleeping quarters, preventing commotion, fright, etc., are needful. Cod-liver oil and phosphorus has

the same beneficial effect that it has in rickets, probably because so many of these children have rickets also.

Decided improvement frequently follows taking the child off milk, or very decidedly reducing the amount. This must be continued for a number of months, supplying necessary nourishment in other ways.

In some cases the use of calcium lactate has a beneficial effect. It is quite likely that these cases have associated rickets.

Special symptoms must be treated as they arise. Those that need immediate attention are laryngeal spasm and convulsions. During the attack of laryngeal spasm not much can be done. Throwing cold water on the face or body, or the use of the warm mustard bath are sometimes effective; strong counter-irritation of the skin by mustard paste or brisk rubbing may be tried. Chloroform inhalation is effective in every case if the child takes inspirations enough to be influenced by the chloroform. Bromide and chloral hydrate must be given by rectum, to insure against recurrence, and the baby must be kept under their influence for twelve to twenty-four hours. For a six-months-old baby two grains of chloral and three of bromide may be given per rectum every four hours; if the drugs are given by mouth, only half as much should be used. Antipyrine is also very effective, one grain given every three hours to a baby of six months. Intubation may be necessary to save the child's life during the attack.

Convulsions are treated in much the same manner. Here the warm mustard bath is frequently very efficacious. Chloroform and morphin are the best drugs to control the convulsions at once, and chloroform is the more effective of the two. Where longer effect is desired, morphin must be used, always with the greatest caution. To a six-months-old baby $\frac{1}{60}$ of a grain may be given hypodermically, and to one a year old, twice as much. Later it is best to use either bromide and chloral or antipyrine to prevent further convulsions.

If the convulsions have been due to a recent indiscretion in diet, a purgative dose of castor oil had best be given, followed in two hours by an enema.

EXUDATIVE DIATHESIS.

Definition.—This is a name offered by Czerny to include those infants who have a tendency to develop superficial inflammation of the skin, and of the respiratory and alimentary tracts. Its status as a distinct disease is not by any means settled, but it certainly helps toward grouping a number of cases showing skin, respiratory and intestinal disturbances (combined in the same person), that heretofore were treated for each symptom along the lines prescribed for the part involved, without any thought of a basic nutritional disorder.

Etiology. As is usual in a condition so obscure as this one, there are different theories advanced as to the cause. A decided difficulty arises in the first place in agreeing on the cases that should be grouped under this head. Czerny is rather more inclusive than most clinicians in this country are inclined to be, and this makes an agreement with him as to etiology very difficult. He is inclined to regard improper metabolism of fat as the exciting cause, with heredity as the determining factor. Finkelstein believes the trouble is with the salts. That there is a nutritional impairment in the cases typically presenting this exudative tendency seems certain from a clinical as well as experimental stand-point, as diet of the proper sort will often relieve the symptoms or effect a cure. What the particular item is must await our further knowledge. That uncleanliness, underfeeding, overfeeding, crowding, poor air, etc., play a part in the production of the symptoms is certain, as it is in practically every disturbance of nutrition. Breast-fed children are as prone to it as those fed artificially. It very often comes to our attention first when a child is several years old. It is not more frequently manifested in infants than in older children; it is much more frequent in those that are overfed.

The factor of heredity is shown by the tendency existing in several children in one family, and the frequency with which a history of similar disorders is obtained from the parents. But its development, on an hereditary basis, usually depends on improper food, care, and surroundings.

Pathology.— Children do not die of the exudative diathesis. In fact, they are not made specially vulnerable to other serious disease, and postmortem changes due to the diathesis are difficult to so interpret when death occurs from other causes. The essential points are mild inflammatory or irritative lesions of the skin, respiratory, and alimentary tracts.

Symptoms.—On the part of the skin, the most constant condition is eczema. This is, in the typical case, a weeping, widespread facial eczema, presenting the red, shining, crusted appearance so often seen in fat, overfed babies. Associated with this are other areas of eczema, notably behind the ears, about the genitals and buttocks, and many moist, angry-looking surfaces at the points of contact of two skin surfaces, as in the groin, elbows, back of the knees, etc.; the so-called intertrigo. Frequently the eczema is spread over nearly the entire body (eczema universale); and often there is marked seborrhea of the scalp. Other skin lesions, occurring with this or independently, are prurigo, urticaria and dermographia. It is difficult to believe that many varieties of eczema are due to this diathesis, as Czerny teaches, but the frequent occurrence of the above variety is conclusive. It is more common in fat, overfed children, but does occur also in those thin and undernourished.

Associated with the skin manifestations is a tendency to repeated, exasperating "colds," or catarrhal inflammations of the nose, throat, and bronchi. These often result in the overgrowth of the adenoid and tonsillar tissue, a frequent development in this condition. This in turn results in frequent attacks of acute tonsillitis. A distressing tendency on the part of the lungs shows itself in attacks of severe bronchitis which simulate asthma. Here, as is the case with eczema, it seems unwise to assume that the exudative diathesis is the cause of most cases of recurrent colds and tonsillitis.

On the part of the alimentary tract the most significant sign is the "geographical tongue," mentioned in some detail in a previous chapter. It is the sign that is practically diagnostic of the condition, but its rarity decidedly lessens its value. The attacks of indigestion of one sort and another are frequent but of no diagnostic importance except as they are associated

with the other symptoms. There may be constipation alternating with dyspeptic diarrhea, or the stools may be practically normal for a long period when the other symptoms are in evidence.

Reports as to the constancy of eosinophilia in the blood of these children led to the belief that this was a sign to be relied upon. Later there have been so many conflicting reports that it seems to be not so constant. Many cases with severe eczema do show a high percentage.

Diagnosis.—This requires careful examination, careful history, and usually prolonged observation. Particularly important are the association of eczema, coryza, bronchitis, and slight digestive disturbanes—all of them being known to be recurrent. Other children in the family with the same general condition makes the diagnosis a probable one. The nature of the food the child has been taking is not of great moment with our present knowledge.

Prognosis.—This is good as to life. The condition is so prolonged and so subject to recurrence that it is difficult to estimate the effect of treatment. Generally it can be very much improved, or be made to subside entirely. Symptomatic cure and complete cure are very different matters in this condition.

Treatment.—The treatment of eczema, bronchitis, etc., will be considered elsewhere. Here will be given the dietary indications of various sorts. In the beginning it may be said that children present this condition after being fed in almost any way, but the great majority have been, or are being, overfed. In regard to the theory of fat as the cause, it may be said that an exaggerated form is frequently seen after prolonged use of a generous diet of condensed milk with no other food at all; and the same is true of almost any other diet.

With fat babies the first indication is to cut down the food. This will often result in marked improvement; if there is a troublesome eczema, local treatment of the skin should be instituted. The difficulty with this measure is that the symptoms tend to recur promptly when the diet is increased considerably, and a child cannot be kept indefinitely on a diet so scant that it is uncomfortable and loses weight. Some diet

must therefore be given that prevents the recurrence of the symptoms, if it is possible to find one. It must be admitted that this is often impossible; at least that has been the experience at the St. Louis Children's Hospital.

In the breast-fed, if lessening the food is not sufficient without making the child lose weight, skimmed milk should replace two or three breast feedings. In many cases the indication seems to be to add proteid and salt, which is done when skimmed milk is given. Larosan (calcium casein) or nutrose (sodium casein) will fulfill this indication if added to water containing 0.5 per cent. sodium chloride. Three feedings a day should be given, so that a child 6 months old takes 18 to 20 ounces of the mixture. It may be sweetened with a small amount of sugar or saccharin.

Artificially fed children often show marked improvement under a strict diet, particularly those one or two years of age. With fat, apparently overfed children the food must be limited, but this is not to be relied upon for permanent improvement. They should be fed starch, cereals, vegetables, scraped meat, and, with caution, eggs. With the baby a few months old the indication is to cut down the fat, but it is hard to see where this can be done in an infant fed exclusively on sweetened condensed milk; when condensed milk or other rich carbohydrate has been the food, of course the indication is to cut down the sugar. Where the food has been cows' milk, improvement will often follow removal of the fat and the substitution of starch in some form. Over a year of age the other articles mentioned above are of value. Other food, particularly fats, can be slowly introduced into the diet.

The so-called "eczema soup" will sometimes produce marked subsidence of a severe eczema in a few weeks. It is made by coagulating the casein of a quart of milk, straining, and passing through a fine hair sieve. To this is added six ounces of whey, one-half ounce of granulated sugar, and water to make one quart. This may be used for three or four weeks, followed by the gradual addition of other food. Weight loss must be watched, and this, with the trouble of preparing it in the home and the difficulty of making a child take it for long, renders its use rather impractical.

Fresh air, cleanliness, and a healthful mode of life generally, have the same value here as in other nutritional disorders.

Medicines to assist the cure of the underlying cause are of no value. Local applications are needed for the seborrhea and eczema, and proper treatment of the respiratory affections as they seem to be indicated.

ACIDOSIS.

Definition. — This is a symptom-complex occurring in a variety of conditions, and cannot as yet be considered as a disease in itself. There is in infants and young children a fairly distinctive group of symptoms associated with an acetone odor of the breath and the presence of considerable quantities of acetone bodies in the urine; this condition has been called acid intoxication.

Etiology.—The various theories as to how the fatty acids are produced, what the abnormality of metabolism is, what predisposes to it, and what the condition is that actually causes the symptoms, differ so widely that they cannot even be mentioned here. There is general agreement that the imperfect metabolism of fat may result in the circulation in the blood of large amounts of fatty acids; these require for their neutralization large amounts of alkali, principally ammonia, which must be furnished by the body tissues. The blood is thus impoverished of alkali and contains an unusual amount of acid – this combination resulting in the toxic symptoms.

Inability to properly digest and assimilate fat and proteid during a certain short interval must be accepted at present as the most likely exciting cause of acidosis; what causes this inability is unknown. Acidosis occurs constantly in diabetes mellitis, often in the toxemia of pregnancy, following general anesthesia, in starvation, and in many of the severe infections, as well as other conditions. Epidemics of severe acidosis, one with a mortality of 71 per cent., have been reported by competent observers; but the evidence of an infectious origin is very slight.

The severe forms occur most often from one to two years of

age, in the better class of babies. Indiscretions in diet cannot often be blamed, as children usually develop it on the diet on which they have thrived.

Among older children the nervous, excitable ones of the better class seem more prone to it than others.

Pathology.—The only lesion that has been observed with any regularity is fatty degeneration of the liver with marked enlargement. In fatal cases death occurs generally within a very few days, and inflammatory or toxic lesions are rarely shown in other organs. Cases of extreme severity and sudden death exhibit the changes of acute yellow atrophy of the liver.

Symptoms.—Most striking is the peculiar, sweetish odor of acetone on the breath; this is sometimes so strong that it permeates the whole room. With this there is a great increase in the ammonia in the urine, together with acetone, diacetic, and oxybutyric acids. Rarely there is leucin and tyrosin.

Other signs are low fever, deep, rapid breathing, prostration, fast pulse, flushed face with pallor of mouth and nose, sometimes alarming collapse. These symptoms are particularly those of coma in diabetes, and after surgical operations under general anesthesia.

The condition known as cyclic vomiting is so distinctive that it is taken up separately.

Symptoms of the acute acid intoxication of infants are so well defined that they may be considered as a distinct entity. There is usually a prodromal period of two or three days in which there is apathy, normal or slight rise of temperature, poor appetite, and coated tongue. Rather suddenly there develop the toxic symptoms. The temperature rises to 101° or 102° F., rarely higher, the breathing becomes rapid and deep, drowsiness or coma develops, with flushed cheeks and lips, and pallor about the mouth and nose. If the air hunger is extreme, the child may be very restless or delirious, and cyanosis may develop.

Vomiting is rarely absent and may be severe, nothing being retained in the stomach. Often there is diarrhea. Physical examination shows enlargement and softening of the liver, and no other change.

The sweetish acetone odor of the breath may be noticed the first day, generally by the second; in some cases of apparently typical acidosis it has been absent throughout. The urine always contains a large excess of ammonia compounds, and considerable acetone, diacetic and oxybutyric acids, the so-called acetone bodies.

Diagnosis.—This can only be made definitely by the odor of the breath, or the considerable amounts of acetone bodies in the urine, associated with the evidences of illness. Some cases with high fever show neck rigidity, increased reflexes, stationary pupils, and closely resemble meningitis (meningismus). The breathing, and peculiar flush of the face, associated with very much enlarged liver should arouse suspicion of this condition.

Too much attention should not be paid to small amounts of acetone in the urine; traces are present in normal urine.

Prognosis.—Recognition of this condition, and observations on it are of such recent development that the prognosis is obscure. It is a grave condition when it occurs with severe symptoms. Parke has reported a series of cases in Birmingham, Ala., with a mortality of 71 per cent.; Metcalf reports a series of 100 cases in Concord, N. H., with a mortality of 9 per cent. In diabetes and following severe operations it is dangerous and needs prompt recognition and treatment.

Treatment.—In the light of our present knowledge this resolves itself into measures to counteract the acid formation. Giving sodium bicarbonate by mouth, by rectum, or subcutaneously, is the procedure recommended. Large amounts must be given, from 1 to 3 drams a day, dissolved in water. Glucose given in the same way is advised by some, the carbohydrate lessening or preventing the formation of fatty acids from the splitting of fat. Both are best given with large amounts of water if diarrhea and vomiting have been severe. Prompt evacuation of the bowels should be secured. This is particularly advisable because many cases have been reported where absolute constipation developed in a few days; these cases have been mistaken for obstruction of the bowel. Other treatment is entirely symptomatic.

What measures can be taken to prevent the attacks are

decidedly obscure. In all probability the intoxication develops after some other cause has operated to derange the metabolic process or lower the general resistance; diabetes, shock, mild acute infections, or some of the many digestive disorders. These produce acidosis in a child susceptible to it.

CYCLIC VOMITING.

Definition.—This consists of attacks of vomiting lasting several days and recurring at intervals of several weeks or months, without ascertainable cause. Usually all efforts to control it are unavailing, and it ceases spontaneously after a longer or shorter time, the child then being at once perfectly well.

Etiology.—This is another manifestation of acidosis, and the metabolic derangement is the same as above described. Acetone, diacetic and oxybutyric acids are regularly found in the urine, together with the greatly increased ammonia compounds.

The great majority of the attacks begin from the second to the fourth year. Investigations as to preceding attacks of acidosis of another form have not been made; it is quite likely that they will be found to have occurred.

The children are usually of the better class, and there is a distinct tendency among the more nervous, excitable children; usually there is a nervous taint in the parents. No fault can be traced to the diet as a rule. Slight illnesses may induce an attack, and in this there is a confirmation of the belief in some preceding illness being the exciting cause of acute acid intoxication. In these children any acute infection, as scarlet fever, measles, influenza, is apt to set in with uncontrollable vomiting, without the urinary evidence of acidosis.

Pathology.—There is none. No fatal case has been reported.

Symptoms.—The attack is ushered in by one or two days of languor, anorexia, pallor, coated tongue, and slight abdominal distress. The temperature is usually normal, never high. After a few days of vomiting the fever may rarely rise to 102° F.

Vomiting begins suddenly and is distressing; it may be almost constant every half-hour or hour. At first the contents of the stomach are expelled, later gastric juice with mucus, bile, or traces of blood. There is no desire for food, but thirst is often extreme. Prostration is frequent and increases in severity, often becoming extremely alarming, with pallor, soft, rapid pulse, and shallow, irregular breathing; the deep, toxic breathing of acute acid intoxication is not seen. The urine is scanty, concentrated, and contains the excess of ammonia, etc. The urinary abnormalities are present the first or second day. There is usually nothing distinctive about the bowels, but constipation is the rule; this may be the case for several days before the attack, and should be the sign of danger of an impending attack in a child subject to this vomiting.

Diagnosis.—This usually cannot be made until the vomiting begins and proves uncontrollable. Then the presence of the characteristic bodies in the urine, together with absence of other ascertainable cause for the vomiting, make the diagnosis.

A history of previous attacks is conclusive.

Prognosis.—This is good as to life. The symptoms last from two days to a week; very exceptionally longer.

Treatment.—Starvation and free catharsis should be instituted when the prodromal symptoms threaten an attack; sometimes it can be aborted in this way. After the vomiting has begun nothing seems to have any effect on it. Nothing should be put in the stomach, as vomiting is usually excited by it. Absolute quiet and the rectal administration of water to relieve the thirst are essential. When vomiting has stopped, food and drink should be very cautiously begun. Sodium bicarbonate and glucose are indicated as in acidosis. Some success is reported from the use of pancreatic extract in combination with the soda. The difficulty here is retention by the stomach.

To prevent recurrences of this vomiting certain measures are sometimes of value. Limiting the amount of milk and cream, or cutting milk out entirely. Forcing the amount of carbohydrate in any form, particularly cereals. Frequent,

regular courses of treatment with sodium bicarbonate, with calomel purging, seem of decided benefit.

Recently Goldthwaite, of Boston, has suggested the importance of correcting faulty posture, such as stoop-shoulders, lordosis, etc., as a measure of preventing this condition, as well as certain other obscure nervous disorders that have hitherto been extremely puzzling.

CHAPTER VII.

DISEASES OF THE DIGESTIVE SYSTEM.

DISEASES OF THE STOMACH AND INTESTINES.

PYLORIC STENOSIS AND PYLOROSPASM.

Definition.—These are closely allied conditions occurring in early infancy, usually in the first few weeks of life, characterized by frequent or constant vomiting and the failure of the food to pass from the stomach into the intestines, either at certain intervals (pylorospasm) or continuously (pyloric stenosis).

Etiology.—The etiology of pylorospasm is unknown. It occurs more often in nervous and excitable infants, and often the parents exhibit the nervous temperament. It occurs in both breast and artificially fed babies, more often in the latter.

Pyloric stenosis is probably a congenital affection due to hypertrophy of the muscle of the pylorus. The theory is advanced that the condition begins as a spasmodic contraction of the muscle and that this results in hypertrophy and consequent stenosis. Congenital hypertrophy has the greater evidence in its favor. There is no question but the hypertrophy increases after birth, rendering the stenosis more and more complete.

Pathology.—This consists in an overgrowth of the muscular tissue of the pylorus. In stenosis this finding is constant, and the opening in the pylorus may be so small as to admit only a fine probe. With this is associated some hypertrophy and dilatation of the stomach. Other changes in the body are those due to starvation.

Pylorospasm sometimes shows apparent hypertrophy of the pyloric muscle, but the rarity of postmortem examinations makes this an indefinite feature.

Symptoms. - Pylorospasm has no definite symptom other than vomiting that occurs frequently and cannot be explained by any indiscretion in feeding, or by any evidence of illness. It occurs without any assignable cause. The amount is not larger than the probable amount taken at the last feeding. Occasionally there is observed peristalsis of the stomach and intestines. Rarely a small, hard tumor can be felt in the pyloric region. These babies are usually constipated, but show no marked weight loss or weakness from too little food. Skiagrams taken after a bismuth meal show marked interference with the passage of the bismuth into the duodenum. Symptoms develop in the first few weeks, sometimes almost at once after birth, rarely at three or four months.

Pyloric stenosis is first evidenced by vomiting, sometimes in the first few days of life, more often after two or three weeks. The vomiting is forcible, the entire contents of the stomach are expelled, and sometimes an accumulation from two or more feedings. Usually it occurs after every feeding, particularly after several days of vomiting. There is no evidence of pain or discomfort. Often it is projectile, the vomitus being thrown a considerable distance. It consists simply of the food taken, partly digested or not at all. It is very rarely stained with bile, seldom containing much mucus. Constipation develops and increases until the stools are infrequent, small, dark, and resemble meconium. This is due, of course, to the small amount of food reaching the intestines. With this there is no accompanying evidence of any other disturbance of digestion. Loss of weight is an early symptom and soon becomes extreme, in severe cases being two ounces a day. The hunger and thirst are always distressing. According to the severity, that is, the completeness of the obstruction, the outward evidences of starvation develop, pinched face, wasting, weakness, rapidly passing to unconsciousness and death.

Peristalsis of the stomach is the most characteristic, visible sign. It is seen best after feeding and presents a round tumor slowly moving from a point under the ribs on the left side slightly upward and to the right, where it disappears just to the right of the median line. Sometimes the waves follow one

another rapidly, sometimes three or four minutes intervene. They are seen much better after several days of vomiting; then there is always a fulness of the abdomen in the stomach region, with retraction below.

A tumor can usually be felt in the pyloric region. It feels very firm, is readily movable, is about the size of the end of the finger and about one inch long.

Diagnosis.—Early diagnosis is of great importance, especially in the cases of true stenosis. A difference of a few days will render the child too weak to withstand the necessary operation. It must be suspected when repeated vomiting manifests itself in a young infant. Peristalsis and tumor make the diagnosis almost certain. It is important to remember that there is no associated digestive disturbance; the tongue is clean, the breath sweet, there is no fever nor evidence of indigestion. The fulness of the upper abdomen, with retraction of the lower, is an important point in diagnosis.

Prognosis.—In pylorospasm the outlook is good. Even under proper treatment the spasm is apt to persist for weeks or months. Any baby that needs operation, or dies from the obstruction, probably has a hypertrophic stenosis.

The stenosis is a very serious condition, with a mortality variously reported at from 40 to 60 per cent. The mortality depends on the delay in operation. When the diagnosis is made early and the operation performed while the child is in good condition, the chances are good for recovery.

Treatment.—Pylorospsam requires very careful regulation of the diet in quality, quantity, and interval. Fat is slower in digestion than proteid or carbohydrate and should be given from 0.5 to 1 per cent. Proteid is best given in some form which does not form a large curd, as whey protein or peptonized milk. Milk or cane-sugar may be used. The percentages and the amount depend on the age and the cessation of the vomiting; both the amount and the interval must be regulated according to the vomiting. Usually it is best to give small amounts at frequent intervals, rather than a large amount every four hours. One of the most efficient measures is feeding entirely by gavage. Every bit of nourishment or water is given by passing a catheter into the stomach; if

necessary the stomach may be washed out with water or soda solution before the feeding is introduced, one or more times a day. There is no medical treatment. If the case does not respond to these measures, it is probably a stenosis, and operation should not be delayed if the baby is steadily losing weight and strength for three or four days. Breast milk should be tried in the bottle-fed baby.

The treatment of stenosis may be dismissed with the statement that it is entirely surgical.

Recently an operation has been devised which seems superior to all others both in simplicity and in results. It consists in splitting the pyloric muscle longitudinally and allowing it to spread. The defect is simply covered over with omentum and allowed to heal in this condition. This procedure will probably take the place of all others.

As soon as the diagnosis is made, operation should be performed. In a case with the typical signs described above this is easy. The border-line cases must be watched closely for loss in weight with continuation of vomiting. If under the closest supervision weight loss is steady for four days, it is best to operate. Babies with this type of vomiting are usually best watched in a hospital.

DILATATION OF THE STOMACH.

This may be either acute or chronic. Acute dilatation is of infrequent occurrence in children, usually being a terminal condition to pneumonia, heart disease, or severe infection of some sort. It should be remembered that acute dilatation not infrequently follows surgical operation; it may then simulate hemorrhage, peritonitis, or other grave complication, and apparently be the cause of death.

Chronic dilatation occurs usually from overfeeding, and is seen in the great majority of instances in rickety children with constipation. A moderate degree of dilatation often occurs in childhood, constant or intermittent, and can be disregarded. It has been mentioned as occurring regularly in pyloric stenosis.

Pathology.—The enlargement is symmetrical, and must reach a considerable degree before it attracts attention by symptoms. In acute cases it may be so large as to impede the action of the heart.

Symptoms.—Vomiting is a constant symptom, but is usually infrequent, not more than once a day; the amount of the vomitus may be enormous. Other signs are those due to the distention; this can only be definitely determined to be due to the stomach by filling with water and observing the lower line of the fluid, which will be the bottom of the stomach. Pressure symptoms, such as difficulty in breathing, and irregular heart action, may be due to acute dilatation and be extremely difficult to interpret.

Prognosis.—Acute dilatation may be fatal, particularly if it occurs in a very sick child. Chronic dilatation not due to obstruction offers no danger to life.

Treatment.—Any underlying cause, as rickets, must receive proper attention. Acute dilatation due to surgical shock, severe typhoid, pneumonia, etc., can only be relieved by passing the stomach-tube. In chronic dilatation the indication is to restrict the amount of fluid and the feeding in general. Feeding should be along the lines of that in chronic indigestion, which is always associated. Washing out the stomach once or twice a day may be beneficial in obstinate cases. Nux vomica is valuable as a stimulating tonic.

ULCER OF THE STOMACH.

Ulceration of the stomach of any sort is a rare condition in childhood. Small hemorrhages may occur as part of a general hemorrhagic process, as in melena neonatorum; superficial peptic ulcers occur as a consequence of acute gastric inflammation, and are usually benign; tuberculosis of the intestines may be accompanied by a similar process in the stomach; finally, the familiar perforating ulcer of adult life occurs rarely.

The *symptoms*, *diagnosis* and *treatment* follow the lines of the same conditions in adults. The *prognosis* is generally poor.

Under this heading it is appropriate to mention the occur-

rence of ulcer of the duodenum, which of late years has been found to be more frequent in children than was formerly believed. It is very much more frequent in infants, and occurs in babies in the same hospital, and in a number of cases at about the same time, to such an extent that the belief in a specific infection as the cause must be considered.

Most cases are observed in the fall and winter months. There is no known etiological factor. The symptoms are extremely obscure, the diagnosis only being made post-mortem, perhaps with terminal symptoms due to severe hemorrhage or to perforation. The mortality is probably high, but it is possible that the condition is even more common than is suspected and some or many cases develop ulcers and recover.

Inasmuch as treatment must depend on the diagnosis, and this is as yet difficult or impossible, any suggestions for treatment are futile.

GASTRIC INDIGESTION.

Definition.—This is a condition in which the stomach cannot properly perform its functions, either from abuse in feeding or from functional inability.

Etiology.—This includes a great variety of causes. Functional incapacity is usually associated with a similar condition in the intestines. Imperfect development of the digestive function, chronic weakening disease of any sort, poor nutrition, or the use of too much food or food difficult to digest, are the common causes.

Acute indigestion is usually due to taking too much food, or food of a decidedly indigestible character. This is usually fruit, particularly if unripe, sweets, pies, and any other unsuitable material. Very frequently it occurs in infants from giving solid food too early. The infectious diseases, especially scarlet fever, are sometimes ushered in by an attack of acute indigestion.

Pathology.—In simple cases with complete recovery, on emptying the stomach there is no pathological change. When the process continues longer, there may be seen catarrhal inflammation, rarely severer degrees. If due to the swallowing

of irritating or corrosive matter, any degree of irritation or necrosis may be seen.

Symptoms.—In infants this is usually only vomiting. If any other symptoms are present, it means the onset of one of the previously described nutritional disorders. Not rarely a convulsion ushers in the attack.

In older children the symptoms begin suddenly, or have a short prodromal period of headache, haggard appearance, restlessness and sometimes vague abdominal pain and uneasiness. Soon the vomiting begins, nearly always associated with some fever, which may be as high as 104° F. The child then complains of dizziness, headache, and usually feels, and looks, very sick. If the attack is a mild one, and relieved immediately by vomiting, practically none of the above symptoms are present, the child feeling much better as soon as the stomach is emptied. Vomiting may be frequent and very distressing; it then contains much mucus, and before long is tinged with bile. By this time the tongue is coated and the breath foul; often these signs are present in the beginning.

After the first or second day the symptoms may have entirely abated, but often there remain slight fever, nausea, lack of appetite, great thirst, weakness and lassitude, with still the coated tongue and foul breath. The attack usually lasts from three days to a week.

Chronic gastric indigestion usually shows itself in a frequent tendency to moderate or, occasionally, severe attacks of the acute variety. Otherwise it is manifested by frequent vomiting, poor appetite, daily indefinite pains in the abdomen, constantly coated tongue and bad breath. Always there are associated the evidences of malnutrition, underweight, anemia, disturbed sleep, etc. These children are much inclined to constipation.

Prognosis.—This is good unless the underlying condition, in the chronic form, cannot be removed. If the condition is a fault of nutrition, it can usually be cured. An acute attack may be fatal, rarely from acute dilatation or convulsions.

Treatment.—In acute gastritis the indication is to completely empty the stomach and bowels at once. Copious drinking of warm water, which is immediately expelled, ful-

fills the first; if the vomiting has been very copious and complete, this will not be necessary. Calomel usually is better retained than anything else, and should be given in small, frequent doses; from 1 to 2 grains may be given. For the vomiting, cracked ice, perhaps flavored with wine or brandy, is usually soothing. Milk of bismuth or milk of magnesia often assist materially; if the vomiting persists, one-quarter to one minim doses of phenol may be added. Cold applications to the head often relieve the headache and to some extent allay the fever. Moist or dry, hot applications to the abdomen may relieve abdominal pain and nausea.

Food should be stopped completely, which is not difficult because there is no desire for it. Beginning the food should await desire for it.

When feeding is begun, it is best to use very readily digestible food; diluted milk, junket, whey, egg water flavored with orange-juice. Gradual return to the regular diet should follow complete subsidence of the symptoms.

There may be such severe pain that the use of opium is needed; it should never be used until the stomach and bowels have been thoroughly evacuated.

In chronic gastric indigestion the greatest difficulties are encountered. It is nearly always necessary to get a very complete history of the previous diet, manner of living, exercise, sleep, and so to determine the underlying cause of the condition. Treatment must follow the lines indicated in each individual. The condition is not nearly so common as the acute form.

Diet is most important. Nourishing, simple, well-prepared food must be given exclusively, and at regular intervals. If the teeth are in poor condition, they must be attended to. A life of careful hygiene should be insisted upon, with proper exercise, sleep, and bathing.

Stomach-washing, with plain, very warm water is the best local treatment. This is usually difficult to employ with older children, and its place may be supplied by giving large draughts of water as hot as can be taken comfortably, thirty minutes to an hour before eating, one or more times a day. Often it is advisable to use 1 per cent. bicarbonate of soda.

Bitter tonics given before meals are of value if the child does not object to them too strenuously; an excellent one is citrate of iron and quinine in sherry wine, one grain for a child two years old. Nux vomica or any other stimulating tonic may be used. Where there is a known, or suspected, deficiency of hydrochloric acid, it may be supplied; it is best given during or after meals, largely diluted with water. The importance of drugs is not great.

INTESTINAL INDIGESTION.

Definition.—This is a digestive disability on the part of the intestines similar to gastric indigestion. It assumes many forms, and is often difficult to distinguish from other chronic illness.

Under this heading are grouped all acute intestinal disorders not due to infection, and not covered in the chapter on disorders of digestion and nutrition in infants. Acute and chronic indigestion are so intimately connected that they are considered together.

The discussion is complicated by the fact that it is often impossible to tell whether the acute disease is due to improper food, weakened digestion from one of many causes, or to actual infection of the intestinal tract.

Etiology.—Acute indigestion occurs most frequently at the time of weaning, when solid food is begun; it becomes progressively more rare as the age and digestive powers increase. Unsuitable food is the commonest cause, among which are green corn, cabbage, tomatoes, raw fruits, poorly cooked cereals, pies, rich desserts, sausage, pork, etc. Any of these are likely to cause indigestion in children of any age. Severe emotional disturbance, particularly fright, may be the cause in susceptible children. Excessive heat, exposure to cold, occasionally difficult dentition, the acute infectious diseases, anything, in fact, which lowers the child's tolerance. Attacks are therefore more frequent in the very hot weather, among the poor who live in crowded, dirty, ill-ventilated quarters.

Chronic indigestion is due to repeated or, occasionally, single severe attacks of the acute form. More often there is

some antecedent infantile digestive disturbance, or simply a lack of digestive power. Prolonged or chronic disease of any sort may be the cause; or poor, unhygienic surroundings with lack of proper or sufficient food. Rickets is a common cause.

Pathology.—In the acute form there is no pathology other than a hyperemia of the intestinal mucosa. Any other lesion is due to infection or other more serious process following the indigestion.

Chronic indigestion shows only a catarrhal inflammation of the mucosa; either hypertrophy or atrophy of the mucous membrane cannot be considered as lesions of simple indigestion.

Symptoms.—These usually begin suddenly with abdominal pain which may be extremely severe; they are usually described as intestinal "cramps." At first the stools are normal, but usually on the first day the diarrhea begins, nearly always with a slight fever. The child becomes weak and exhausted very soon if the diarrhea is severe; more often the subjective symptoms are not marked; if they are, there is usually gastric indigestion associated, and vomiting occurs soon. The stools are watery, not very offensive, yellow or brown, more rarely green, and from four to eight a day. Peristalsis can be felt by placing the hand on the abdomen, and the child complains frequently of pain due to peristalsis, most often just before the bowels are evacuated. Often there is tenderness to pressure all over the abdomen. There is very little appetite, but usually considerable thirst.

The symptoms rarely last longer than two or three days, and the child feels quite well again. If severe and prolonged, it may develop into a chronic indigestion, or become more serious from an infection of the intestinal wall.

Chronic indigestion makes a fairly definite clinical picture, and is very common. These children are always manifestly undernourished and often thin, with small arms and legs and a large abdomen. Often there are evidences of other chronic illness. They are inclined to be cross, do not enjoy play, sleep poorly, and usually feel badly when they get up in the morning. Grinding the teeth at night is a frequent symptom.

All sorts of nervous manifestations are seen in these little

patients, some of them alarming, such as spells of extreme weakness, days of stupor with cold hands and feet, pallor, irregular pulse and breathing. These are most apt to occur during periods of constipation.

The bowels usually are constipated and the stools light in color; they may be nearly white and extremely foul. Generally there are attacks of diarrhea at more or less frequent intervals. Rather characteristic is a tendency to have a fairly normal stool in the morning with two or three more during the day that are increasingly loose, light in color, foul, and containing undigested food; this is not a frequent condition. Of course these children are subject to frequent attacks of acute indigestion, with diarrhea.

The appetite is capricious, but most cases eat very poorly. Pain of any sort is not prominent. Unless the stomach is affected there is ordinarily a clean tongue and the breath is not offensive.

The urine contains an excess of indican, most in those cases with troublesome constipation.

Treatment.—The first indication is to give a cathartic, of which the best is castor oil. If calomel is used, it is best given in one dose, as the action then is quicker. It is often advisable to follow either with an enema after four to six hours. When the intestines have been cleared, it may be necessary to use some drug to stop a troublesome diarrhea. Paregoric is the best agent, and usually there is no contra-indication to its use; five drops every two hours may be given to a child a year old, increased to ten if no effect is seen after two doses. Bismuth subnitrate suspended in blackberry cordial and peppermint water (equal parts) is often very effective.

Food should be withheld for a day or two as indicated. After a day or two more usually the regular diet can be instituted, but this must follow the indication on the part of the child. Recovery is usually prompt, more so than in the gastric indigestion.

Chronic indigestion requires very careful treatment, but the results of intelligent treatment and care are generally excellent. In general the younger the child, the more difficult is the treatment and cure. Preventive treatment is most

important, but this consists largely in general education of the public, and is not to a great extent possible for the physician.

Diet and hygienic care are far more important than drugs. As the child is usually on an improper diet, this should be ascertained as to every item, the amount, frequency, and regularity of the meals. This will nearly always give the indication as to the diet to employ. A favorable change of climate, particularly in the summer, is often advantageous, but not often possible. Plenty of fresh air, proper sleeping quarters, regular exercise and play, must be insisted upon. Very young children may have to be fed on the very easily digested foods, whey, junket, broths, liquid peptonoids, raw egg, and milk. It is not advisable to keep on this sort of food for long, as the ability to digest other food should be maintained. Directions as to diet, etc., must be carried out to the letter, and this must be impressed on the parents.

Children two or three years old should be given food which contains a great deal of nourishment in small bulk, with exclusion of starch, and small amounts of sugar and fats. Rare beef, raw egg shaken up in skimmed milk; beef broth, buttermilk, and skimmed milk. When improvement has set in, the malted foods may be added to increase the carbohydrate; if this is well borne, well-cooked starches are added in the form of thick cereal jellies. As improvement is still manifest, other food can be gradually added, other forms of meat, as lamb or mutton; cooked fruit, vegetable purée, etc. Crackers, bread crusts, and dry toast can be tried in small amounts any time after the first period of improvement. Liberties of any sort should not be taken with the feeding until after several months of improvement, and such a child can probably never be fed as can a perfectly normal one.

Still older children must be fed along the same general lines, except that they usually show improvement more rapidly if well-cooked and readily digestible vegetables are given almost from the start. The indication is to cut down the starches of all sorts, lessen the sugar, and lessen or cut out entirely the fat. These children often show a decided intolerance for the fat of cows' milk, and this must be withheld after other fats are being given.

Drugs aid in this condition only to a very limited extent. The most useful one is probably salicylic acid, or one of its salts. It should be given in suspension in liquid, 1 or 2 grains after meals.

Bismuth and salol have a similar effect. None is likely to do any harm. General tonics are sometimes of great assistance, though they are best withheld until the child has been on a proper diet for some days. Nux vomica is probably the best. When improvement has definitely begun, it may be wise to give iron or arsenic if there is considerable anemia; there should be a very definite indication for them, however.

Drugs for constipation are very unsatisfactory. This usually improves with the general condition. Calomel, given in small doses at intervals of several days, does sometimes have a good effect. Cascara and phenolphthalein are sometimes good. Castor oil has too decided an effect in increasing the constipation for several days after it has acted. Agar-agar and mineral oil may be tried. In cases where there is a great deal of mucus passed with the stools, occasional colonic irrigation with normal salt solution is helpful.

Relapses from slight indiscretions are very frequent, and parents must be particularly and repeatedly warned against them.

DYSENTERY.

(Ileocolitis.)

Definition.—This is an inflammatory disease of the intestines in which pathological changes of various sorts take place. It seems rational to group under this head all the diarrheal diseases caused, in all probability, by infections.

Etiology.—The great majority of cases follow some preceding digestive disturbance. This has been considered in a measure under the title of Intoxication. Many cases of intoxication undoubtedly depend on subsequent infection for their prolongation, and often for many of the symptoms. The subject is so confusing that in infants little attempt is made to separate intoxication and infection. Older children, however, are subject to a similar process, called also ileocolitis, which seems to be due to one or another sort of in-

fection. In some cases the Shiga bacillus has been demonstrated as the probable cause; in others a very similar organism, the Flexner type. It seems now quite certain that the streptococcus is responsible, either primarily or secondarily, for another group. Sometimes the colon bacillus or other normal inhabitants of the intestine seem to be pathogenic. There is no doubt at all as to the specific ameba infection. Certainly we must accept the possibility of disease of the intestine from infection by many microörganisms.

In what manner infection takes place is not known. Probably some previous disturbance paves the way for the infection in the great majority of instances. Attacks are seen most frequently in summer, but may occur at any season. They often follow the acute infectious diseases; measles, diphtheria and pneumonia most often.

Pathology.—This varies remarkably. Fatal cases show the widest extremes of intestinal involvement. The most pronounced lesions are in the ileum and colon. These fatal cases showing only a catarrhal inflammation probably belong exclusively under the heading of Intoxication, and will not be considered here. Older children who die of this disease nearly always show ulceration in some portion of the intestinal mucosa.

The great majority of cases show a follicular ulceration, taking place in the solitary follicles of the intestine; these are located in the lower part of the ileum and largely in the large intestine. Catarrhal inflammation is always present, with marked injection of the mucosa. The ulcers sometimes are quite large from coalescence of two or more smaller ones. Sometimes they are located entirely in the colon, and always the majority of the lesions are there. Where the ulceration is considerable, the gut presents a peculiar worm-eaten appearance. All the areas of adenoid tissue are thickened, infiltrated and stand out prominently, giving a studded appearance to the membrane.

Much the most severe form is that showing the formation of a fibrinous membrane over a considerable portion of the colon, often in its whole extent; sometimes the ileum is affected in its extreme lower portion. The lesions are so severe that

often they have caused such marked constitutional symptoms that disease of the intestines was not suspected as the primary illness or the cause of death; probably the condition is uniformly fatal.

The intestinal wall is much thickened and feels stiff. The mucous surface is rough, granular and in places intensely red and congested. No membrane can be seen usually in gross preparations, but the surface sometimes presents a yellowish or dirty gray color, and the normal structure is entirely obscured. There is no ulceration. There is no other similar process elsewhere in the body, in fact, no characteristic change of any sort other than the intestinal. Microscopically, the membrane shows an exudation of fibrin which forms a nearly complete or quite complete pseudomembrane over the mucosa. It sometimes infiltrates the mucosa or even the submucosa. Contained in the network of fibrin are many small round cells, some red cells, and many bacteria. Small round cells also infiltrate the mucosa and submucosa to such an extent that the glandular structure may be obscured or entirely destroyed.

The commonest lesion elsewhere in the body that is found in any sort of dysentery is bronchopneumonia. Deep ulceration of the intestine with perforation is practically unknown.

The pathology of amebic dysentery is no different from the same condition in adults, and is extremely rare in children. The same tendency exists to formation of abscess of the liver, but this is naturally so rare as to need only mentioning.

Marked enlargement of the mesenteric lymph nodes is seen in nearly all cases of dysentery.

Symptoms.—The great majority of cases have some preceding illness, generally of the intestinal tract; therefore the onset of intestinal infection is attested by increased severity of the symptoms of a previous disease. Weak, poorly nourished children may have symptoms that point to infection right from the start. Any case presenting the early symptoms of dysentery which sharply subside on the withdrawal of food are probably cases of intoxication.

Usually, therefore, there are a number of days or a week of evident digestive disturbance of some sort. The intestinal

infection shows itself by a rise in temperature which continues high, from 102° to 104° F. The stools become very frequent, contain much mucus or consist almost entirely of mucus, and occasionally streaked with blood; later blood may show in nearly every stool. Curiously enough the blood is apt to lessen after a few days with other symptoms manifestly unfavorable. Also after the first few days they frequently become fewer in number. The color then is brown or dark green, not watery, and as they become fewer they are much more offensive. Usually after the first week the temperature ranges from 100° to 101½° F.

Vomiting is not common except in the beginning of cases with abrupt onset of symptoms; throughout the disease it rarely continues.

There is a steady loss of weight and strength, with growing dulness and apathy. Appetite is poor, it usually being difficult to get these children to take nourishment. Emaciation becomes extreme, the skin being dry, wrinkled, and hanging in folds on the limbs. Fluids are usually taken readily. The abdomen is relaxed, sunken and not tender. The mouth is dry, the tongue and cheeks red and shiny, or the tongue may be coated and thrush be present, with dry, fissured, bleeding lips, and sordes on the teeth. A distressing tendency is the formation of bed-sores, excoriations about the buttocks, and pus infections in the skin.

Fatal cases last from two to three weeks as a rule. Convalescence is always prolonged, perhaps for several months, and the child is extremely subject to relapses on the slightest addition to the food. There is great danger from any of the intercurrent infections for many months after convalescence has begun.

The membranous form is extremely severe from the outset, and the constitutional symptoms often entirely overshadow the intestinal, so that attention may not be particularly directed to the bowels. Fortunately it is very much more rare than the preceding. In the form in which the intestinal symptoms are unmistakable the disease begins abruptly with high fever, vomiting, and large, watery stools. The abdomen is distended and tender. There is severe, cramping pain in

the abdomen, particularly preceding the bowel movements, and there is often prolapse of the rectum. The rectum is then seen to be intensely congested and sometimes the pseudomembrane may be observed on the mucous surface; this is rarely the case. The stools contain blood, mucus, and often small flakes of fibrin; severe hemorrhages never occur. In the severer cases there may be vomiting, high temperature, delirium, convulsions; prostration and stupor intervene. Later the intestinal symptoms become more pronounced and the case is evidently a dysentery. Cerebral symptoms may be so prominent as to strongly resemble meningitis.

The duration of this form is from one to three weeks and its result usually fatal; cases that recover should be regarded with suspicion as to the diagnosis. Older children do undoubtedly recover in some instances. Death results from exhaustion, general sepsis, pneumonia, or other infection.

Diagnosis.—The less severe form is apt to be confused with typhoid fever, or rarely with intussusception; the very severe with meningitis. The course of typhoid fever is often very obscure in children, but the slower onset, more constant temperature, enlarged spleen, distended abdomen and the eruption, with the Widal reaction, should serve to differentiate. Intussusception, with the lack of fever, abrupt onset, vomiting, cramping pains, rapid prostration, and the constipation with bloody, mucous stools, should not be mistaken; stercoraceous vomiting, tumor, and collapse, cannot be mistaken. The membranous form may need a lumbar puncture to differentiate from meningitis.

It is often quite impossible to decide whether a given case presents one form of dysentery or another. Diagnosis of the amebic form is only made by finding the organism in the stools. The latter disease is a chronic one, as in adults, and important from the severity of its complications and the great difficulty in curing it.

Prognosis.—This is grave in every case. The outcome had best never be given as favorable in any instance, especially if the child was in poor condition at the outset. The younger the child, the poorer the outlook. And the occurrence in hot weather is decidedly unfavorable. Never forget the tendency

to relapses, even when the child is apparently improving rapidly.

Treatment.—In the way of prevention, special attention should be paid to the careful feeding of all children during their years of liability to this disease. All details of fresh air, cleanliness, and sanitation should be regulated in the best way possible for each individual case. Especially will prompt treatment of all minor forms of digestive disturbance prevent the onset of this form.

In the treatment, a change of air to a cooler climate will often work marked and rapid improvement; this is not often possible. A common observation is that these children do not do as well in hospitals as when they are taken care of individually in a home; this necessitates, of course, proper treatment and intelligent care.

If a child has been recently weaned, the employment of a wet-nurse may be advisable; this should not be continued if the symptoms do not soon abate. No milk should be given but skimmed or buttermilk, much diluted at first. Meat juice, peptonoids, scraped meat, egg albumen, albumen milk, all may prove of value. It is usually more difficult to get the children to take enough than to feed them too much. All food should be given at regular intervals, not oftener than every three hours, with plenty of water or thin gruel between. As improvement occurs, increases in the diet should be very carefully made to prevent exacerbations of the disease.

Irrigation of the colon is particularly valuable in this condition. It is best to precede this with an effective dose of castor oil or calomel, the former being preferable. Injections are given through a large catheter inserted well up into the sigmoid. One or two quarts of saline solution at blood heat are slowly injected, endeavoring to distend the entire colon at one time. This may be done twice a day, later on once a day. If the temperature is very high, cool water may be used. Astringents rarely are indicated, and then after the acute symptoms have subsided. Thin starch water sometimes has a very good effect, and if tenesmus is marked, five or ten drops of laudanum may be added to it. Tenesmus that is not thus

relieved may yield to suppositories containing $\frac{1}{8}$ to $\frac{1}{4}$ grain of cocain.

Cases with very active peristalsis, severe pain, frequent stools with rectal prolapse and tenesmus need opium given by mouth. The best form is paregoric, given in repeated small doses rather than one large one. Caution should be exercised so as not to cause constipation. It is often necessary to give a laxative several times in the course of the disease. Bismuth in large doses, 10 to 20 grains every four hours, often has a beneficial effect, particularly in the later stages of the disease; it is well to give it suspended in blackberry cordial.

Alcoholic stimulants frequently are necessary, and do a great deal of good. Brandy and whisky are the best forms in which to give it, and they are indicated in any sort of exhaustion at any stage of the disease. Thirty drops every three hours should be given to a child two years old.

When acute symptoms have subsided and the greatest need is building up the strength, it is best to dispense with medicines and pay particular attention to the diet. Giving some gastric stimulant may be advisable if the appetite is persistently poor. Irrigations of the colon are of value until the stools approach the normal. When convalescence is well established, the usual tonics often prove useful, particularly the mineral acids, and nux vomica. The use of iron and arsenic is best delayed until the appetite has returned; they are given then if indicated.

CHRONIC DYSENTERY.

Definition. This is a chronic catarrhal inflammation of the intestinal mucosa with more or less thickening of the membrane and destruction of glandular tissue. Occasionally the membrane of the stomach shows the same changes. Under this heading come those cases called "mucous colitis;" the disease is rarely confined to the colon.

Etiology.—Most often it follows the acute variety, nearly always the catarrhal or ulcerative form. In a way it is comparable to the condition of marasmus, but in marasmus there is no change in the intestinal structure. Sometimes it occurs as a consequence of chronic constipation in anemic, poorly fed

children. Chronic indigestion may result in such a catarrhal inflammation, but probably always because of the tendency to develop repeated acute attacks of diarrhea.

Pathology.—In the great majority of cases there is a catarrhal inflammation of the membrane, principally in the lower ileum and colon, often extending throughout the intestine, and rarely in the stomach. Inspection shows infiltration of Peyer's patches and solitary follicles, causing them to project above the surface; brownish pigmentation may occur in these areas. The mesenteric lymph nodes are swollen and firm.

Microscopically, the mucosa shows considerable change. The lymphoid patches show a marked hyperplasia; in cases of long standing there is a growth of connective tissue in and about these patches. Most important is the lessening of the tubular glands from strangulation by the overgrowth of new connective tissue spreading from the walls of the blood-vessels. This causes a thickening of the mucosa and sometimes of the submucosa.

Ulceration is much less common, and always associated with marked catarrhal inflammation. These ulcers may be seen in all stages of healing and cicatrization; they never result in stricture. Where there has been much destruction of gland substance, there may often be seen mucous cysts, caused by the dilation of occluded glands; rarely these are prominent enough to be seen in the fresh specimen, and practically always in the colon.

Very frequently congestion of the lungs is found post-mortem, and often bronchopneumonia, which is often the cause of death. Fatty degeneration of the liver and cloudy swelling of the kidneys are often found in cases that have had a very long course.

Symptoms.—The moderate cases form almost a separate type, as they have developed usually from long-continued irritation of the intestinal mucosa and not from a preceding severe illness. There are the symptoms of chronic intestinal indigestion with several offensive stools containing much mucus. The abdomen is sunken and relaxed. Often it is sensitive along the course of the colon, particularly in the

region of the sigmoid. In sufficiently thin and relaxed abdominal walls one can often feel a flexible, cord-like mass, somewhat tender, which can be recognized as the colon.

These children are thin and undernourished, but do not present evidences of serious illness. They are subject to frequent acute digestive disturbances. Other symptoms conform in a mild way to the more severe form.

This is seen most often in the fall following the severe, acute infections. The acute symptoms have subsided. There is no pain nor tenderness, other than that elicited at times by deep pressure on the colon. These children are fretful and irritable, but mostly when disturbed. They take food with avidity but show little other evidence of hunger. Characteristic of the condition is the progressive emaciation and failing strength with no symptoms of acute illness and with an abundance of food. In fact, they show the paradox reaction of marasmus, and lose weight faster the more they are fed. Finally, the appearance becomes one of appalling emaciation, with the pinched face, sunken eyes, hollow cheeks, depressed fontanelle, and the skin wrinkled and hanging in folds on the limbs. The lips and mouth are dry, the teeth covered with sordes, often there is thrush or various degrees of stomatitis; the tongue is dry and red, less often thickly coated.

The stools are thin, not watery, containing a great deal of mucus, rarely blood. They average from four to six a day, are of dark green or brownish color, and generally very offensive. Rarely they may be of nearly normal consistency, but contain undigested food, much mucus, and are dark brown in color. As the disease progresses the abdomen nearly always becomes distended, usually from dilatation of the colon.

The pulse is rapid and feeble, the extremities cold, the temperature often subnormal. These children sleep poorly, and whine and fret when disturbed or irritated. More rarely there is apathy and stupor. They are subject to exacerbations, or to infections of any sort, which they are little able to withstand.

The duration of the disease is two or more months, and the

convalescence is always protracted. Progress is nearly always irregular, there being intervals of improvement, in favorable cases, followed by weeks of stationary weight.

Diagnosis.—The cases of catarrhal inflammation with little change in the intestinal structure are difficult to differentiate from chronic indigestion. The severe form is characterized by progressive weakness and emaciation without severe symptoms, and on a sufficient diet. Syphilis, tuberculosis, or other chronic disease must be excluded.

Prognosis.—This is generally bad, except in the mild form. If continuous symptoms have existed for two months, the outlook is extremely bad. If other disease develops, it is usually hopeless.

Treatment.—Here a change of climate is often the most important item. Plenty of fresh air, careful bathing, and intelligent individual care are essential; and extremely careful feeding. Great care should be taken to prevent sudden changes of temperature, as these children are very susceptible to cold.

The use of drugs is best dispensed with as a routine measure. An occasional dose of castor oil is of benefit, but it must be used as indicated. Opium is rarely needed, but it may be used to quiet unusual, painful peristalsis. Alcohol is the best stimulant, and it should be given in moderate doses, well diluted, and omitted from time to time to see if it can be dispensed with. Irrigations with mildly astringent solutions, as 1 per cent. tannin, are sometimes of much value; they are best preceded by salt solution to wash out the mucus. Violent struggling contra-indicates their use.

One-half pint may be used, being retained in the colon for ten to twenty minutes.

Feeding is along the same lines as indicated in the recovery from the acute form. Fat and starch are usually badly borne. Otherwise the diet must follow the special indication. No attempt should be made to make the child gain in weight until the stools have shown very decided improvement. Even then increases in the diet must be made with caution.

CHRONIC TUBERCULOUS ENTERITIS.

Definition.—This is a tuberculous process affecting the intestinal wall, nearly always producing ulceration, and always showing a tuberculous involvement of the mesenteric lymph glands.

Etiology.—It is due to infection by the tubercle bacillus which has gained access to the intestinal canal. In the great majority of cases these are swallowed with the sputum, and derived from antecedent tuberculosis of the lungs. The glands are usually infected from the intestines. Instances in which the glands are probably primarily infected are rare and positive proof is difficult; this must, of course, take place through the general circulation.

The great majority of cases are from two to four years of age and intestinal lesions are found in 50 per cent. of the autopsies on tuberculous cases. The condition is frequently found up to the eighth year. In the rare instances where the intestinal lesion is not due to tuberculosis elsewhere in the body, it is probably always due to milk containing the organism, usually the bovine type.

Pathology. Any portion of the intestine may be invaded. Much more often only the jejunum and ileum are affected, occasionally the cecum. Ulceration of the rectum is rare and usually a distinct process. The early lesions consist of very small yellow nodules in Peyer's patches. By necrosis and sloughing these form very small ulcers which spread or coalesce to form areas of considerable sizes, as large as two or three inches in diameter. They tend to extend around the circumference of the gut, and by cicatrization may cause narrowing of the lumen with stenosis. They may extend into the submucosa, the muscular coat, or to the serous coat; rarely they perforate. Adhesions between two sections of the intestine by inflammation of the serous coats is not uncommon. These complications are rare because death from tuberculosis elsewhere occurs before the intestinal process goes so far. General peritonitis from perforation is exceedingly rare, as the process is preceded by a plastic inflammation of the serous

coats that causes them to adhere and shuts off the infection from the general peritoneum.

The mesenteric lymph glands are greatly enlarged, and usually a great many of them. They may reach the size of large plums, and by exudation into the serous lining they may become adherent to one another and form tumors as large as the fist, easily palpable through the abdominal wall. The process of softening and caseation is the same as that of lymph glands elsewhere in the body.

Symptoms.—These are so obscure as to be exceedingly difficult to interpret. Ulcers are frequently found postmortem when there have been no intestinal symptoms to attract attention during life; this is probably so in the majority of cases On the contrary, diarrhea is very common in tuberculosis when the intestines are not involved. The diarrhea due to tuberculous ulceration is very obstinate, and is the common symptom. There is nothing characteristic about the stools, but they always contain blood, perhaps demonstrable only by chemical tests, and always contain tubercle bacilli; of course these may be present in the stools of children having pulmonary tuberculosis, without tuberculous enteritis, as may be swallowed blood. Other symptoms are occasional localized tenderness in the abdomen; and later the presence of tumors due to enlarged glands. There is usually progressive wasting, and, as the disease advances, irregular fever.

Diagnosis.—This can be made positively by finding the bacilli in the stools in considerable numbers. Signs of tuberculosis nearly always are present elsewhere in the body, especially in the lungs. The slow onset and slow progression usually serve to differentiate from other severe, chronic intestinal lesions; the latter usually have some antecedent acute illness from which they develop.

Prognosis.—This is distinctly bad, principally because there is nearly always extensive tuberculous involvement elsewhere which is the cause of death. Death rarely occurs from the intestinal lesions. The ulcers rarely heal, hence the danger of stenosis from scarring is remote.

Treatment.—From the foregoing it follows that treatment is very unsatisfactory. Attempts to heal the intestinal lesions

are useless. Treatment of the diarrhea consists in efforts to control it. This is best done by bismuth and opium, separately or in combination. Irrigations are of no value, as the lesions cannot be reached by that means. Otherwise the treatment is that of tuberculosis elsewhere.

HIRSCHPRUNG'S DISEASE.

(Congenital Dilatation of the Colon.)

Definition. This is a rare condition characterized by obstipation, tremendous enlargement of the abdomen, progressive weakness, and death. It is due to inability of the colon to empty itself, resulting in great dilatation. Hirschprung, of Copenhagen, first described it.

Etiology. The condition described by Hirschprung is congenital in children otherwise perfectly healthy. There is either complete atony of the colon, or an abnormal length of the sigmoid so that proper evacuation cannot take place. Another type, occurring after several months of good health, manifests itself in exactly the same way. In these cases the theory is that there is a congenital abnormal length and tortuosity of the sigmoid which results in stasis only after the beginning of an alteration of the diet.

Pathology. This shows as the primary lesion tremendous dilatation of the colon, which may almost fill the greatly distended abdomen. The muscular coat shows areas of thinning and atrophy, with other areas of thickening and hypertrophy; the hypertrophy is presumed to be the essential lesion, the atrophy being secondary from distention and pressure. Other lesions are those of malnutrition in general.

Symptoms. In the typical case it is noticed soon after birth that the baby's bowels do not move. The child appears healthy and there is no evidence of intestinal obstruction. The child soon becomes restless, sleeps poorly, the abdomen shows progressive slight enlargement, and the bowels do not move spontaneously. Laxatives have no effect; enemata very little. The abdomen becomes tense, the veins in the skin dilated, and this increases to a tremendous extent, pro-

ducing the balloon-shaped belly seen in no other condition. Dyspnea and cyanosis may result from compression of the lungs. The bowel can be partially evacuated only by injecting large amounts of fluid and then using pressure and massage. This results in temporary relief. There is progressive weakening and emaciation, together with mild or severe nervous symptoms from absorption of toxic material. A reasonable degree of comfort and health can only be maintained by the most strenuous efforts to secure evacuation of the colon every few days.

The cases that develop in older children usually come at the time of changing to some form of solid food. The onset is slow, usually preceded by weeks of increasing constipation. The further course is practically identical with the above.

FIG. 8.—Showing the tremendous distention of abdomen in Hirschprung's disease. (Case at the St. Louis Children's Hospital.)

Diagnosis. There are no distinctive points about the diagnosis. It can only be made by the complete constipation without other ascertainable cause.

Treatment.—This is purely symptomatic, to secure evacuation of the large bowel. Any measures may be tried; no medicinal or mechanical ones have proved successful. The cure, if one is possible, consists in surgical removal of the colon. This has been tried, but so far without effecting a cure. The children usually die of intoxication and exhaustion.

APPENDICITIS.

Definition.—This is an inflammation of the vermiform appendix, attended with very definite local and constitutional symptoms.

Etiology.—It is a frequent disease, but occurs much more commonly in young adults than in children. It is exceedingly rare under two years of age, but cases have been reported in infants only a few weeks old. It is rather frequent after five years, and increases in frequency with each succeeding year. Nearly two-thirds of the cases are boys.

The actual cause of the condition is infection of the mucosa of the appendix. This is usually the streptococcus, less often the staphylococcus, and each often accompanied by the colon bacillus. The exciting cause is largely speculative, but the frequency with which hard fecal masses are found in the appendix in cases of infection leads to the belief that they in some way interfere with the circulation or injure the wall of the appendix. Foreign bodies are rarely found, pins having been reported by various operators. Attention has been called to the frequent presence of pin-worms in the appendices of young children; it seems quite likely that they may rarely be the exciting cause. It is uncertain whether unusual length or position of the appendix is of any importance. Chronic constipation seems to predispose to attacks.

Pathology.—The appendix may be the seat of a simple catarrhal inflammation, with congestion and swelling of the mucosa and increased production of mucus. If the process stops here, resolution takes place and the appendix returns to normal, without the symptoms having been severe. Such an inflammation may perhaps be induced by the presence of pin-worms.

If the inflammation is more severe, the appendix becomes distended with the inflammatory products, the lumen into the cecum being closed. In this condition the entire thickness of the appendix is affected, as is the peritoneal surface. Infection of the neighboring peritoneum then may take place with the formation of a localized peritonitis and a walled-off abscess. Even if no abscess results, there are adhesions

formed which may cause trouble by constriction. This is comparatively rare in children.

Ulceration of the mucosa with resulting perforation is the result to be feared in appendicitis. Such a perforation may lead to a localized peritonitis with the formation of an abscess. But in the majority of cases the result is a generalized peritonitis.

Gangrene of the greater part, or the whole of the appendix occurs in severe cases, sometimes with surprising rapidity. Portions of the appendix may become detached, of course resulting in a general peritonitis. Of great importance is the fact that gangrene of the entire appendix is often accompanied by marked temporary subsidence of the local symptoms.

Inflammation and ulceration are sometimes caused by the typhoid or tubercle bacillus.

Symptoms.—The disease usually begins with sudden, sharp abdominal pain, at first general or located anywhere in the upper or right part of the abdomen; but it is soon localized in the region of the cecum. With the pain there is fever of a moderate degree, nearly always vomiting or nausea, not infrequently a chill, and a leukocytosis from 15,000 to 30,000. The bowels are usually constipated, but there may be some diarrhea.

The most important sign on examination is the tenderness in the right iliac region, with rigidity of the right rectus muscle. Tenderness can often be localized in one small area, called "McBurney's point," one-third of the distance on a line drawn from the right anterior superior spine of the ileum to the navel. Localized tenderness and rigidity are extremely difficult to make out in a young child. Any pressure on any part of the abdomen is sure to induce crying and resistance. Great patience, and very gentle manipulation are necessary. It is wise to gently examine first the distant parts of the abdomen, coming to the region of the appendix later. And it is very unwise to be content with an outcry and spasm of the muscle at the first touch in that region; exert pressure again elsewhere, and then return to the appendix again and again, to make sure of the localized pain and rigidity. An important point is the frequent position of the right leg, or both legs, held

flexed, and the expression of pain when the thighs are straightened. Any attempt to move the lower part of the body is painful.

If the inflammation is very severe, with localized or general peritonitis, the symptoms are of corresponding severity. Often a mass can be made out in the right iliac fossa, caused by adhesions and matting together of the intestines; an abscess may form a very definite, palpable, or even visible mass. These signs are present only after several days. Generalized peritonitis does not differ from that from other causes, the cause being interpreted from the history.

The suddenly perforating and gangrenous cases may give no signs in the beginning different from the milder attacks, and in a few hours present all the symptoms of a diffuse peritonitis with general septic infection. It is impossible to decide in the beginning which are to be the mild and which the severe cases. No one symptom or combination of symptoms can be relied upon as to the nature of an attack, and every case must be carefully and intelligently watched. It is well to remember that the onset of gangrene may be accompanied by very marked lessening of pain, tenderness and discomfort, after symptoms of a severe infection. Hence perforation not infrequently follows a subsidence of the symptoms. Perforation may occur at any time after the first few hours, usually not before the third day. It is evidenced by sudden increase in the pain, rapid pulse, vomiting, and the symptoms of intense shock. Often there is a sharp fall in the leukocyte count, followed soon by a very great rise. The temperature usually falls suddenly and then rises again.

If the general peritoneal cavity is walled off by adhesions, the acute symptoms gradually subside and the patient is left with a circumscribed peritonitis with or without an abscess. The abscess, if not evacuated, may perforate the colon, bladder, or may travel to any point in the peritoneal cavity. If permanent adhesions do not form and the general peritoneum is infected, there is the usual picture of diffuse peritonitis, with its high mortality.

After spontaneous recovery from a primary attack, the child may have recurrent attacks, any one of which may result in

any of the above conditions. This is decidedly less frequent in children than in adults. Less frequent also are the vague disturbances, with pain, uneasiness, indigestion, etc., due to chronic appendicitis.

Diagnosis.—The typical case of appendicitis is easy as far as diagnosis is concerned, if the patient is a child of four years or over; in infants and very young children it is extremely difficult. Remember that it is impossible to decide from the signs and symptoms, in the early stages, what pathological condition exists in the appendix. Treat every case as a dangerous one.

In differentiating appendicitis from other conditions in children, ordinary colic and intussusception are most likely to cause confusion. Acute pneumonia with pleurisy of the right base has been mistaken for appendicitis; typhoid fever with marked pain and tenderness on the right side has been interpreted as appendicitis; here the leukocyte count is invaluable. Perinephritic abscess, acute pyelitis and acute indigestion both offer symptoms at times that are confusing. Appendicitis should be thought of in every case of sudden, severe pain in the abdomen, accompanied by fever. There are many signs said to be indicative of appendicitis, but for these refinements in diagnosis one is referred to a text-book on surgery.

The important points in diagnosis are the sudden onset with fever and vomiting, sharp abdominal pain, and the tenderness with muscular rigidity. In every such case a leukocyte count should be made, if there is the least doubt as to the diagnosis.

Prognosis.—This is always grave; the course is apt to be rapid and the severe complications occur more frequently in children than in adults. Many cases recover from one or more attacks under medical treatment; recurrences are extremely likely. With early surgical treatment the best results are obtained, as the chances for recovery before the development of peritonitis are good. A localized abscess resulting from peritonitis which has been walled off offers a favorable outlook with incision and drainage. General peritonitis is fatal in the great majority of cases, though the outlook then is much better in older children than in the very young.

Treatment. When appendicitis is suspected, the child should be kept absolutely at rest in bed, with an ice-bag applied to the right iliac region. An enema should be given early to clear the large bowel, but a cathartic should not be given. The advice of a surgeon should be obtained at once. Surgical treatment is more often necessary than medical.

It is unquestionable that the mortality from appendicitis has been lessened by early surgical operation. Physicians are more and more becoming convinced that this is the proper procedure as soon as the diagnosis has been made, unless there is some special contra-indication. The earlier the operation, the more favorable is the outcome, as the most alarming condition may develop at any time, and the operative treatment become much more difficult.

It is wise for the physician and the surgeon to watch these cases together from the outset if operation is delayed, as the need for it may arise at any time.

INTESTINAL OBSTRUCTION.

Under this head is included any mechanical interference with the passage of the bowel contents from one portion of the bowel to another. In children there are not so many causes of this condition as in adults, but any of the commoner adult conditions may exist. The rare forms of obstruction will be mentioned only, but the one common, important variety will be described in detail.

Strangulation of a hernia should never be forgotten as a cause of acute intestinal obstruction; strangulation, or kinking of the gut, may be caused by abnormal bands from a previous, healed peritonitis, by a small loop of intestine pushing through an abnormal opening in the mesentery, abnormal opening in Meckel's diverticulum, or adhesions from a chronic appendicitis. Foreign bodies may rarely be the cause of obstruction, masses of caked drugs, as bismuth, or accumulations of agar. A lump of lumbricoid worms rolled and twisted into a large mass has been found as the cause. Dynamic ileus, such as in the adult is caused by thrombosis of a large mesenteric artery, is exceptionally rare.

INTUSSUSCEPTION.

This is very much the most common form of obstruction in children.

Definition.—It consists in the invagination of a portion of the intestine into another portion immediately adjacent to it, either above or below. This mechanical situation, together with the swelling of the affected parts, closes the lumen of the bowel; and the traction and compression of the mesentery shuts off the circulation, with resulting stasis or even gangrene of the bowel wall. The degree of traction, etc., determines the severity of the case.

Varieties.—Invagination may occur at any portion of the bowel, but it is decidedly more frequent in certain sites.

The commonest location is at the ileocecal valve, the terminal part of the ileum pushing through the valve and forming the intussusceptum, as the entering portion is called, and the cecum forming the intussuscipiens, or receiving portion; a greater or less portion of the colon nearly always becomes invaginated after a few inches of the ileum have entered. This is called the ileocecal form. It comprises about four-fifths of all cases. Sometimes those cases in which the colon does not become invaginated after the ileum are classed separately as ileocolic intussusception.

Enteric intussusception is that form in which one portion of the small intestine is invaginated into another portion. This form comprises about one-tenth of all cases, but is slightly less frequent than the third variety.

The third variety, colic intussusception, consists in the invagination of one portion of the colon into another portion.

Intussusception may occur in two places at once. It usually takes place in the direction of peristalsis, that is, with the apex downward, but the reverse may rarely occur.

In the production of artificial, experimental ntussusception the apex, or intussusceptum is fixed, the enfolding portion being drawn up over it. In the ordinary variety a few inches or several feet of the bowel may be involved.

Intussusception of the bowel occasionally is found post-mortem when no symptoms have been present during life.

This is called intussusception of the dying, and has no clinical significance. It is usually multiple, descending, and involves only short segments of the bowel, showing no other pathology. It may occur during the last moments in any disease.

Etiology. - The great majority of cases occur under one year, the time of greatest frequency being from the third to the ninth month. After one year the tendency lessens with the age. Nearly two-thirds of the cases occur in boys, for which fact there is no explanation. Most cases occur in previously healthy children. Previous intestinal disorder is present in a small proportion of the cases.

Pathology. The essential lesions are due to the torsion and constricting of the vessels of the mesentery, and to the occlusion of the opening of the bowel. If the first is severe, there occurs venous stasis, congestion of the bowel, and later gangrene; sloughing of gangrenous portions of the bowel sometimes occurs. Occlusion occurs from swelling of the walls of the intestine, or from the pulling of the stretched mesentery which causes the apex of the intussusceptum to be turned against the wall of the intussuscipiens. Reduction of the tumor is often made difficult by the fact that the two peritoneal surfaces of the bowel form adhesions; with this is nearly always associated decided swelling of the walls. If these adhesions form, and if the strangulation of the mesentery is complete, the entire intussusceptum may slough, or parts of it, and be discharged entire, or piecemeal, through the rectum; very rarely spontaneous cure may in this way result. If such sloughing occurs without the formation of peritoneal adhesions, it may lead to perforation of the gut and infection of the general peritoneum.

Symptoms.—Sudden, severe abdominal pain is the first symptom in a great majority of the cases. It is usually located in the region of the navel, and is so severe that the child is in agony. This severe pain comes in paroxysms, and vomiting begins within a very few minutes. The first vomitus is the contents of the stomach, later considerable amounts of fluid strongly tinged with bile; still later fecal matter may be vomited, but this occurs in only a small proportion of cases, and rarely before the third day. The

vomiting is forceful, projectile, and nothing is retained by the stomach. At first there are one or two loose, fecal stools; after a few hours there is nothing passed except blood and bloody mucus. These bloody stools may be frequent and associated with marked rectal tenesmus. Soon after the attack begins, between the paroxysms of pain, the abdomen is relaxed, and the tumor may be felt. This is an extremely important sign. It may be felt in nearly every case at some time. It is most often felt somewhere along the region of the transverse or descending colon, or by inserting the finger in the rectum; this latter manipulation will discover the tumor in nearly half the cases within the first twenty-four hours. When felt through the abdominal wall, it is usually a soft tumor, considerably longer than it is broad, very often curved with the concavity toward the interior of the abdomen; this has resulted in the descriptive term "sausage-shaped," as applied to this form of tumor. In rare instances a portion of the tumor protrudes from the rectum.

As the condition advances, usually by the second or third day, tympanitic distention develops; with this may be associated tenderness of the entire abdomen, or only in the neighborhood of the tumor. This occurs without the development of peritonitis. The temperature is normal or subnormal in the beginning, but usually rises by the end of the second day. A rapidly rising temperature is a very bad sign.

The condition of the little patient is striking in an acute case of intussusception. There is intense prostration, feeble pulse, pallor, cold extremities, all the signs of what is familiarly known as shock. In this condition there is a marked diminution of the amount of urine, due to the persistent vomiting. Such cases usually die in four to seven days if the intussusception is not reduced. Death occurs from shock, probably induced by intoxication from the abnormal intestinal contents, as experimentally demonstrated by Murphy and Brooks at Washington University. This variety represents the great majority of cases.

Subacute and chronic cases occur with all sorts of modifications of the above symptoms. In them a positive diagnosis can be made only by discovery of the tumor. Without

operation these cases usually die from exhaustion or the development of complications.

Diagnosis.—In seeing a case with a typical history the most important thing is to have in mind the possibility of intussusception. Then a careful examination will usually reveal the tumor. Never neglect making a rectal examination. In all cases of bloody discharge from the bowels, think of intussusception as well as infectious intestinal disease; they are easy to differentiate if both are kept in mind. In chronic cases the tumor is the most important diagnostic point.

Prognosis.—This is always grave. The younger the child and the more advanced the case, the more serious is the outlook. Even with early diagnosis and proper treatment the mortality is over 25 per cent. Spontaneous reduction and recovery after sloughing of the intussusceptum are both exceedingly rare; the former does undoubtedly occur. Chronic cases seldom recover.

Treatment.—When the diagnosis has been made, operation should be performed without delay. Every hour's delay increases the danger. Do not give a cathartic. This can do no good, and only increases peristalsis and increases the invagination. Opium may be given in sufficient amount to relieve pain, and at the same time reduce peristalsis; it should only be given after operation has been discussed and decided upon.

Any attempt at mechanical reduction other than laparotomy is not advisable. The results are too uncertain, except that in the great majority of cases they do no good and only delay the proper proceeding. Inflation of the colon with gas or liquid is the measure often recommended. The uncertainty as to the amount of force employed, the ignorance as to whether the intussusceptum points up or down, and the slight chance of accomplishing the reduction make inflation an unwise procedure if operation can be performed.

INTESTINAL PARASITES.

Varieties.—There are several varieties of parasites that may inhabit the intestines of children, giving rise to discomfort or actual illness. In this country the ones most commonly

found are the round-worm, Ascaris lumbricoides; the pin-worm, Oxyuris vermicularis; the hook-worm, Uncinaria americana; and two varieties of tape-worm, Tenia mediocanellata and Tenia solium.

Worms, however, are very much less common than is ordinarily supposed by the public at large. In a large clinic, such as the Washington University Out-patient Department, infection with the pin-worm is rather frequent—infection with any other parasite is rare.

The life history of each form is different, and as each requires a special treatment, and the worms themselves are decidedly dissimilar, a separate description is necessary.

Round-worms.—Description.—These worms are from five to ten inches long, the female being the longer. They are perfectly cylindrical, as the name implies, taper sharply at both ends, and are of a pinkish-gray color; they are therefore much like the ordinary angle-worm in appearance, but the ends are much more pointed, and their consistency much firmer. It is much more frequently met with than is the tape-worm. In infancy it is excessively rare; usually it is seen after the second year; after seven or eight years it is seen less frequently.

The worms live in the small intestine and rarely occur singly. Usually the number is from five to ten, but there may be a hundred of them. They occasionally roll up together into a large mass, and have been known to cause the symptoms of a tumor in the abdomen. They have a most remarkable tendency to wander from their natural location in the small intestine and appear in stomach, bile duct or gall-bladder, the liver, trachea, or even the Eustachian tube. Not infrequently they are vomited, and the diagnosis thus made without its having been before suspected. They may cause intense jaundice by blocking the common bile duct; cases are reported of perforation of the intestine, with their escape into the general peritoneal cavity, of course, causing a general peritonitis; and there are remarkable, authentic reports of the escape of numbers of round-worms through the abdominal wall in cases of fecal fistula.

The eggs are slightly oval in form, about $\frac{1}{400}$ of an inch

long, with a faintly granular body and thick, irregular cortex. They are stained yellow from the feces, but *in utero* are colorless. They are discharged by millions with the stools, and have great vitality outside the body. They develop into larvæ in water or moist earth, and infection of children occurs when the larvæ are swallowed with the food or the drink. In the intestine the retaining shell is digested and the mature worm develops.

Symptoms.—The most important thing to bear in mind is that there are no definite symptoms by which the diagnosis can be made other than seeing either the worms or the eggs. The worms are rarely passed with the stools; the eggs always are.

The most frequent abdominal symptoms, any or all of which may be due to something other than worms, are irregular abdominal pains and tympanites; restlessness, disturbed sleep, picking of the nose, grinding the teeth, particularly during sleep; the appetite is apt to be poor or capricious, and attacks of indigestion frequent.

Round-worms are much more likely than any other parasite to be responsible for a variety of nervous symptoms that are extremely puzzling; rarely they closely resemble organic nervous disease. Of these—headache, dizziness, irregular chills, "flighty spells," hysterical attacks, general convulsions—all have been noted, and have cleared completely with the discovery and expulsion of the worms. The symptoms due to mechanical obstruction are rare, and a diagnosis is practically impossible except by routine examination of the stools; jaundice, intestinal obstruction, or other symptoms due to obstruction can scarcely be interpreted as due to worms.

A number of worms may inhabit the intestine for a long period of time without causing any symptoms whatever.

The blood generally shows a moderate eosinophilia.

Diagnosis.—This can only be made by seeing the worms or the eggs. If one worm has been discharged, the probability of others being present is strong. No set of symptoms can be relied upon to make the diagnosis.

Treatment.—The drug to be used in every case of round-worm infection is santonin. For a child of three years it is

well to give it in small doses combined with calomel, and in the form of powder. One grain of santonin with one grain of calomel may be given every night for three nights. The bowels should first be cleared by vigorous catharsis and the child kept on a very light, preferably milk, diet. The poisonous nature of santonin should be remembered. It is quite likely to cause vomiting if given in slight overdose; susceptible children readily show the toxic symptoms, *i. e.*, seeing everything yellow, yellow or reddish urine, uncontrollable nervous excitement.

If the calomel does not induce free bowel movements, castor oil should be given.

The stools should be examined for eggs a number of weeks after treatment.

Pin-worms.—Description.—These are very small, and are called also thread- and seat-worms. The technical name is Oxyuris vermicularis. They are from one-half to two-thirds of an inch in length, the female being the longer and the one nearly always seen in the stools. They look like a piece of fine, white thread, and they taper to a point at one end—the tail. The eggs are oval, about $\frac{1}{5\,0\,0}$ of an inch long, with faintly granular body and thin, regular cortex; they are colorless.

The worms are widely distributed, occurring in every country, and infection with them is very common; children are particularly likely to be affected. They live almost entirely in the rectum and colon, though they travel up into the small intestine; the gravid female is apt to be located in the lower end of the ileum. They are usually present in enormous numbers, and practically always are to be found in the stools of infected persons; the eggs are present also in countless numbers.

Infection takes place by swallowing the larvæ contained in their shells. Food contaminated in one of many ways is the usual source. Self-infection readily occurs from contaminated fingers.

Symptoms.—The most important sign of the presence of the oxyuris is intense itching of the anus and genitals. This is usually worse just after the child goes to bed. Scratching for

relief of this itching may lead to eczema of the anus, or to balanitis or vulvitis. Where the infection is severe and prolonged, the irritation may lead to marked nervousness and restlessness, disturbed sleep, and night terrors. Large quantities of mucus are discharged from the colon from time to time, showing that they have produced a catarrhal inflammation of the colon. Prolapsus ani may occur. Enuresis, frequent urination, and even masturbation, often are initiated by the irritation. Reflex nervous symptoms are much less likely to occur than with the round-worms.

Diagnosis. Itching about the anus and genitals in children should make us suspect pin-worms as the cause, and they should be looked for. The only positive diagnosis rests on seeing either the worms or the eggs. The worms may often be seen by carefully examining the folds of the anus. Always the worms or eggs can be found by a careful examination of the stools. Usually the mother has seen them, and informs the physician of their presence.

Treatment. Scrupulous cleanliness of the patient is the first thing of importance. The parts about the anus should be washed daily and rinsed with some mild antiseptic solution. The child should be made to keep the hands away from the anus and genitals. The anus should be kept anointed with 2 per cent. carbolic salve, or mercurial ointment, especially at bedtime; this prevents the emergence of the worms from the rectum and usually relieves the itching.

To permanently clear the intestines of this little parasite is often a very difficult matter, and recurrences of the trouble are extremely common. To kill the worms that are usually present in the ileum, nothing seems to equal naphthaline in effectiveness. This is best given in capsules, 1 grain four times a day, between meals, after the bowels have been well cleared by means of some saline. This is repeated on three successive days, the above being the dose for a child of three years. After this irrigations of the colon are given every evening for about two weeks. For this purpose from a pint to a quart of fluid should be used, retained for several minutes, or as long as it can be. For this irrigation many solutions are recommended, but nothing seems more effective

than the infusion of quassia chips. If bichloride of mercury is used, it cannot be retained for any length of time without danger of poisoning.

After two weeks it is best to discontinue treatment. If the worms reappear, as they usually do, the same régime must be gone through again. Persistent treatment will usually effect a cure.

Clothing, toys and bedding should be destroyed or disinfected to prevent reinfection, as the larvæ are very resistant to drying.

Tape-worms.—Description.—These are peculiar, flat worms consisting of a greater or less number of segments. The entire worm may be from twenty to forty feet long, but it appears in the stools as short, flat, white or yellowish segments. These decrease gradually in size as the head is approached, the head itself being a very small segment with an end hardly larger than a pin-head; it is attached by hooks to the intestinal wall.

Varieties.—Tape-worms belong to the family cestodes, and there are a number of varieties that develop in the intestines of man. By far the most common in this country is the beef tape-worm or Tenia mediocanellata; next in frequency is the pork tape-worm, or Tenia solium. Others are so rare that they are not described here. Each segment of each variety is a sexually mature individual, and ova are continually cast off by them. These segments are broken off from the tail end from time to time and appear in the stools. New segments grow from the head to take their place. They are the diagnostic point of the condition, and are readily recognized. They are from one-half to one inch long, white or yellowish, and present a striking appearance in the stool.

Cysticercus.—This is a cyst formed by the larva of the tape-worm in the muscle of the animal, steer or pig, that acts as the intermediate host of the parasite. The eggs of the tape-worm are swallowed by the animal in its food. Passing into the stomach, the embryo is set free by digestion of its capsule, enters the blood stream and is deposited in some tissue of the body, generally in the muscle. In the tissue these embryos form a wall about themselves and assume the larval condition.

They are then called cysticerci; each one is about the size of a pea. In this condition they may remain alive, but quiescent, for some years. In the case of Tenia echinococcus this cysticercus stage develops in man, causing the echinococcus cysts of the liver and other organs.

When the flesh of infected animals is eaten by human beings, the heat applied to it may not have been sufficient to kill the larvæ. By the process of digestion they are then set free in the intestine and attach themselves to the intestinal wall; there they grow into adult tape-worms.

Habitat.—The Tenia mediocanellata lives in the bodies of cattle during its larval state, and hence it is called the beef tape-worm. The Tenia solium lives in its larval state in the bodies of hogs, and it is known as the pork tape-worm. More than one Tenia mediocanellata may be found in a patient at one time; but the Tenia solium, as its name implies, is usually single.

Symptoms.—There may be no symptoms at all, and the finding of the segments in the stools may be the first intimation that the worm is present. Irregular pains in the abdomen, capricious appetite, which is occasionally voracious, restlessness, diarrhea, and the ordinary symptoms of indigestion may be observed in some cases. All of these, of course, are more often present when there is no tape-worm in the intestine, as they are evidences of improper nourishment or digestion. A symptom that in the mind of the laity is closely associated with worms is that of picking the nose. This is simply an evidence of nervousness that has become a habit, and is no more a sign of tape-worms than is any other nervous habit.

Diagnosis.—This is made only by finding segments of the worm in the stools. The physician should always examine these himself, as parents will call almost anything a worm that presents a peculiar appearance in the stool. Shreds of undigested orange are quite likely to be so mistaken.

Treatment.—Preventive treatment consists in thoroughly cooking any beef or pork. The infection with the pork tape-worm is quite apt to occur from eating underdone sausage. Thorough cooking will completely destroy the cysticerci.

If the presence of the worm is established, treatment should be at once begun. A period of about 12 hours' starvation is essential.

This is well managed by having the child eat a very light supper of crackers and milk. Before breakfast the next morning give a saline laxative, such as a wine-glassful of citrate of magnesia. After the saline has acted freely, give the specific drug. Food should not be allowed until two hours after this. In the evening, or within two hours after the last dose of the drug, another cathartic should be given, castor oil being the best. The stools should be carefully examined for the long worm, and the physician himself should examine the specimen to assure himself that the head has been passed. This is recognized by its small size, and the fact that it is usually discolored, either yellow or brown. Magnification will disclose the hooks or suckers. If the head has not been loosened, the worm will grow again, and the segments begin to appear in the stools in about three months.

Practically only two drugs need be remembered as tenicides, *i. e.*, male fern and pomegranate. The first is given as the oleoresin, either in capsules or in an emulsion with some syrup. It is not a pleasant mixture, but is decidedly the least expensive of the two drugs. It is quite as effective, if not more effective. The best way to give it is in doses of 10 to 20 minims; six doses, either capsules or liquid, should be taken during the day by a child four years old. Tanret's pelletierine is the extract of pomegranate. It is the pleasantest means of attacking the tape-worm, but its expense is considerable. It is usually given in one dose, with the same precautions as to diet and catharsis.

Hook-worms.—Description.—This is a small, grayish worm, hooked at one end, a little more than half an inch long. It lives in the upper part of the small gut, from the wall of which it sucks blood; it causes a great number of minute hemorrhages and by these considerable blood may be lost. The eggs are eliptical, colorless, smooth, and with a thin cortex. They hatch in the earth, and the diagnosis has sometimes to be made by hatching in the earth the eggs contained in the stools, there being so few of them that it is difficult to find them;

they are rather hard to recognize as hook-worm eggs to one not fairly familiar with them.

This parasite has been brought prominently to our attention by the discovery that it is extremely prevalent throughout the southern portion of the United States. Thousands of persons are there infected, and the number has reached such serious proportions that radical steps are being taken to stamp it out.

Infection takes place in the vast majority of cases through the skin; most often entrance is gained through the skin of the feet and legs, due to the fact that so many of the people go barefoot. Less often the larvæ enter the skin of the hands and arms. The skin at the site of entrance often presents a papular eruption that itches and may cause large sores; this is the so-called "ground-itch." The larvæ enter the circulation and reach the lungs. From there they may migrate into the intestines, or may be coughed up and swallowed. They develop into mature worms in the upper part of the small intestines.

Symptoms.— These are almost entirely due to the secondary anemia caused by the sucking of the worms, and the many minute points of bleeding they cause in the intestinal wall.

This may be profound, the hemoglobin often falling to 25 per cent. Accompanying this are the usual signs of anemia, with certain signs rather characteristic. The mental development is much retarded, these children often being unable to make their way in school. There is a decided lack of energy, they are stunted in growth, and the evidences of malnutrition and emaciation are extreme. The appetite is usually poor, but there is frequently manifested a craving for articles unfit for food, as dirt, clay, etc.; occasionally there is a ravenous appetite.

The blood shows, aside from the anemia, a marked increase in eosinophiles. There is no leukocytosis.

These children commonly have edema of the face, or even a general dropsy, without any albumin in the urine.

Diagnosis.— The history is of great importance. Living in a neighborhood where the worm is prevalent, going without shoes, and the presence at some time of the peculiar itch on

the skin, are all points to be considered. The severe anemia is usually the condition for which relief is sought, and the diagnosis will not be made unless hook-worm is thought of, or unless the stools are examined as a routine measure. The worms are rarely seen in the stools. Eggs may be found by examination; if they are not, and the disease is suspected, part of the stool should be mixed with moist earth, kept warm for a week, and then carefully examined for the encysted larvæ. The stools nearly always contain blood.

Prognosis.—This is excellent if the diagnosis is made early. In severe cases it is not so good, as growth and development may have been so retarded as to make return to normal impossible. The parasite itself can nearly always be expelled.

Treatment.—By far the most important measures are those of sanitation, and instructing those in infected districts that they must wear shoes. This is now being done by the Hookworm Commission in the South.

The specific remedy for the parasite is thymol. This should be preceded by a vigorous saline cathartic given with the stomach empty. Thymol is given to a child of four years in doses of 1½ grains every three hours, four times in the day; it is best given in an emulsion. One or two hours after the last dose the saline should be repeated. Castor oil should not be used with thymol. It is nearly always necessary to repeat this process twice more, at intervals of about a week. Cure is assured only when the eggs are no longer found in the stools.

Prolonged treatment with iron, or iron and arsenic, is practically always advisable.

DISEASES OF THE ANUS AND RECTUM.

PRURITUS ANI.

Definition.—This is an intense itching in and about the anus. It is much less common in children than in adults.

Etiology. The itching is most often due to pin-worms in the rectum; less often to eczema of the anus, to irritation from constipation or irritating discharges, or venereal warts. The constant scratching tends to make it worse by producing local infection or dermatitis; diabetes may rarely be the cause, as may hemorrhoids.

Treatment. If possible ascertain the cause and remove it. Keep the parts absolutely clean by bathing after every stool, or more often; they should then be carefully dried and kept so. If due to worms, the use about the anus of carbolic or mercury salve will help. For the itching itself, many ointments are recommended; as useful as any is menthol 3 grains, tar ointment ½ dram, and petrolatum 1 ounce. This should be applied after cleansing and drying, the excess wiped away, and then a simple powder dusted on.

PROLAPSUS ANI.

Definition.— This is a condition in which a portion of the wall of the rectum projects through the anus. There are two varieties. In one there is a simple eversion of a portion of the mucous membrane of the rectal wall, such as normally occurs in horses after defecation; in the other there is complete prolapse of the entire rectal wall for a distance of an inch or more.

Etiology. This condition is quite common in children during the second and third years. It occurs more readily in young children because of poor muscular support, and particularly in thin children because of the absence of the supporting cushion of ischiorectal fat. It is produced by severe, long-continued straining to evacuate the rectum; severe diarrhea, particularly with associated tenesmus; chronic constipation; or straining due to irritation of the urethra or bladder, as phimosis or stone in the bladder.

Symptoms. The only positive symptom is the projection of the membrane or the entire rectal wall through the anus, usually only during defecation. Sometimes the tumor is persistent and is replaced with difficulty. It is a dark red or purplish, cylindrical mass protruding one or two inches from

the anus. It is covered by mucous membrane which often is in a state of violent inflammation. Often it bleeds freely. In the more severe cases it forms a bulging, flattened, corrugated mass that is readily reduced, but which at once recurs unless restrained by pressure. When prolapse has once occurred, it is subject to recurrence with each stool.

Diagnosis.—The condition must be differentiated from polypus, hemorrhoids and intussusception. In intussusception the invaginated portion often protrudes from the anus. The diagnosis is made by the presence or absence of pain and the other symptoms of obstruction of the bowel; in simple prolapse reduction readily takes place with a resulting normal appearance. This latter fact also serves to differentiate it from polypus, which can be shown to be a pedunculated tumor after reduction.

Treatment.—The tumor should be carefully reduced with oiled fingers, the child lying on the stomach. When there is much difficulty in reduction, cold cloths should be kept applied or cold water dripped on it for several minutes to relieve some of the swelling; in rare cases anesthesia may be necessary.

Immediately after reduction, the buttocks should be held firmly together with strips of adhesive plaster. After this the child should not be allowed to defecate while in the ordinary sitting posture. Very young children should do so lying on the back; it is well to induce the act with the child lying, in order to assure that the child will not do it otherwise when not watched; an enema may be used at this time, and the buttocks held together to prevent prolapse. Older children should recline on a board inclined so that there cannot readily be any effort made at straining: a suitable opening is made and a bed-pan placed below. The same precaution as to recurrence must be used. Often it is advisable to keep adhesive plaster on all the time. It can be so applied that it need not be removed during defecation, and still offer considerable support.

If there is any tendency to constipation, the bowels should be kept open by mild laxatives. Inflammatory conditions of the mucous membrane will usually respond to daily irrigations

with an astringent solution. Tannin is as good as any; it may be begun as a 1 per cent. solution, and gradually increased in strength until 5 per cent. can be used without any discomfort. This measure in mild cases tends to prevent recurrence of the prolapse by contraction of the membrane.

If these simple means fail, intractable cases are practically always cured by linear cauterization of the mucous membrane in three or four places. This should be done under general anesthesia. Nitric acid can be used, followed at once by an application of bicarbonate of soda. Much more exact and easier to control is the actual cautery. The bowels should be cleansed thoroughly before the operation, and afterward should be kept from acting by the use of opium for two or three days.

Very rarely it will be necessary to perform an operation of suspension or amputation.

HEMORRHOIDS.

Definition.—These are vascular tumors growing in the lower portion of the rectum, just above the sphincter, or just below. They are caused by dilatation of the veins under the mucous membrane. They are quite rare in childhood, and when they do exist, they are usually of the external variety.

Etiology.—The cause nearly always is chronic constipation, rarely diarrhea.

Symptoms.—Attention is nearly always attracted to them by pain on defecation. Bleeding occurs from them at times, but never such as to cause symptoms or excite remark, as is often the case in adults. Diagnosis is made by seeing or feeling the soft, vascular masses about the anus.

Treatment.—This consists in the proper regulation of the bowels. For application, the best is a mixture of equal parts of unguentum gallæ and unguentum belladonnæ if the pain is severe, small amounts of cocain may be mixed with the ointment. Frequent cleansing is of value.

Operation is rarely indicated. If it proves necessary, the best procedure is ligation.

ANAL FISSURE.

Definition.—This is a small linear ulcer in the membrane over the sphincter muscle in such a position that it is caught at every contraction of the sphincter. It is fairly common in children, less frequent in young infants.

Etiology.—It always begins as a tiny tear from some traumatism; most commonly this is the passage of hard, dry fecal matter; it may be from the passage of some foreign body, the use of a rough or large syringe nozzle; occasionally vigorous scratching to relieve the itching of pruritis. Usually such lacerations heal very soon without any difficulty. Exceptionally they develop into slightly indurated, discharging ulcers, which are very painful; this is the condition of anal fissure.

Symptoms.—Pain during and after defecation is the constant symptom, and it is sometimes so severe that the child screams each time, and will take any means to prevent bowel movements. Slight bleeding nearly always accompanies the stool. On examination there is seen a grayish, slightly bleeding ulcer at the bottom of a fold in the membrane, extending in a line over the margin of the sphincter.

Treatment.—This is very simple and usually quite effective. The parts should be well cleansed, the ulcer completely exposed, and touched its whole length with the silver nitrate stick. After this application the bowels should be kept well open and the anal margin kept as clean and as dry as possible. If this is not effective, stretching of the sphincter, or incision, may be necessary.

ISCHIORECTAL ABSCESS.

Definition.—This is a collection of pus in the cellular tissue around the lower part of the rectum. It is usually small and circumscribed, and it is exceedingly rare that it burrows as it does so frequently in adults. It is not a rare condition.

Etiology.—Traumatism undoubtedly is a frequent cause. Also it occurs often as the result of infection through the

lymph spaces from the rectum, or elsewhere, just as infection occurs in the cervical glands from infection in the throat.

Symptoms. These are the same as from an abscess anywhere; intense, throbbing pain, fever, restlessness, with marked tenderness of the part affected. Defecation causes the most intense pain.

On examination there is tenderness and induration in the buttock, or at the side of the anus. As it develops there is manifest swelling, redness, heat, and the tenderness increases. Fluctuation may be made out by the time these signs appear.

Treatment. As soon as the pus can be located incision should be made through the skin in a line radiating from the anus, sufficient to secure free exit to the pus. Finger or forceps should be inserted into the wound and any pockets opened and the walls broken. The cavity should be drained, and later packed open so that it will heal by granulation.

ANAL FISTULA.

This is an unhealed ischiorectal abscess, and it is a very rare occurrence in infants and children. It usually results from spontaneous or inefficient opening of an abscess. It consists of a sinus leading from the old abscess cavity into the rectum, into the skin, or extending from an opening in the rectum to an opening in the skin.

Etiology.—The chronic cases usually are the result of a tuberculous infection, and there may have been no history of an acute, painful abscess; in fact, the fistula may exist at the time the abscess is first opened. The more acute cases have had a simple abscess which has been improperly treated.

Symptoms. There is no special pain in this condition, but there is constant or intermittent discharge of purulent or bloody fluid with the stools, or on the clothing, according to whether the opening is inside or outside. Sometimes there is a succession of abscesses, as the opening may temporarily close and allow the fluid to collect. At these times there may be a sense of fulness and some discomfort, but rarely much pain.

On examination the opening will be found, either on the

skin surface or in the rectal wall; if internal, it is sometimes very hard to find; if complete, a probe can be passed through into the rectum, or colored fluid can be forced through to locate the internal opening.

Treatment.—This is entirely surgical. Any variety of incomplete fistula should first be made complete, and then incised through its length. The scar tissue in the wall must be dissected away, any pockets opened and curetted, and the wound packed open to heal by granulation. The sphincter muscle should not be cut in more than one place.

PROCTITIS.

Definition.—This term is used to designate an inflammation of the rectum unaccompanied by inflammation of the colon or other part of the intestine. Proctitis, of course, often exists as an accompaniment of inflammation of the intestinal tract.

Etiology.—The causes are nearly always local. Pin-worms, irritation from hard fecal masses in chronic constipation, irritating enemata, suppositories, or any foreign body inserted in the rectum, are the most common causes. Direct gonorrheal infection is not rare; or there may be infection from without due to other bacteria, particularly in severe illness; it is thus seen most often in measles, scarlet fever, and diphtheria.

Pathology.—Usually there is a simple catarrhal inflammation like that described as occurring in the intestines. More rarely there are small superficial ulcers, generally complicating the catarrhal form, and usually there is then a similar condition throughout the colon. When the infection is more severe, there may be the production of a membrane; though these cases sometimes complicate diphtheria, there is no definite evidence that they are due to the diphtheria bacillus. Probably most cases are due to infection with the streptococcus, whether the primary disease is measles, diphtheria, or anything else.

Symptoms.—The local signs are the most important, often they are the only ones. Constitutional signs are mild or entirely absent, or due to the antecedent disease.

There are frequent stools, passed with considerable pain, and often being almost entirely composed of mucus; tenesmus is apt to be a distressing symptom. Nearly always there is some blood in the stool, or even considerable active bleeding. Prolapsus ani is a frequent complication. Pruritis ani, with excoriation of the surrounding parts, is common and very distressing.

When ulceration exists, it may be of the superficial variety which is associated with catarrhal inflammation, and produce no other symptoms. Sometimes, however, the ulcers are deeper, their course is chronic, and they give rise to marked symptoms and are exceedingly difficult to cure. They are occasionally due to tuberculosis; very rarely to syphilis. The only symptoms to be relied upon are pain in the neighborhood of the rectum, and active bleeding with the formation of clots. If the ulcer is near the sphincter, there may be marked tenesmus. A positive diagnosis can only be made by means of the rectal speculum.

Treatment. In the more acute cases rest in bed should be insisted upon. The bowels should be thoroughly cleansed with castor oil; the diet should be bland, nourishing, and such as to leave little fecal residue; milk, therefore, should be a large part of it.

Daily injections or irrigations of some bland fluid are given; of these nothing is better than thin starch water, with a small amount of laudanum if the pain is considerable.

If deep ulceration exists, prolonged treatment and great patience are required. The same general treatment is necessary, with the use of irrigations once or twice a day. Following one of these a 0.25 per cent. solution of silver nitrate is used. If the ulcer is very low, a stronger solution of silver nitrate can be applied by means of the speculum. It is best to wash the rectum with salt solution afterward to neutralize the silver nitrate. Suppositories of opium or cocain may have to be used for pain and tenesmus.

The cause of the condition should be ascertained and removed, if possible.

RECTAL POLYPUS.

Definition.—This is a localized adenomatous tumor projecting from the mucous membrane, usually of the lower part of the rectum.

Etiology.—No cause for the growth is known. It is not of common occurrence.

Pathology.—The polyp has a glandular structure and is always benign. It is soft, vascular, smooth, and at first is sessile, though it usually becomes pedunculated after some time. The size is that of a hazel-nut; usually there is more than one, and there may be several of them.

Symptoms. The only symptom of importance is bleeding; this is at first slight and occurs at intervals of some days; later it may be nearly continuous and of considerable amount. If the tumor is very low, there may be rectal pain and tenesmus. Rarely the tumor may protrude from the anus, if the pedicle is long enough and the site near the sphincter; this, of course, is most apt to occur at stool.

On examination the tumor is difficult to feel definitely with the finger but can usually be made out as a small mass attached to the membrane; a pedicle may be felt. As seen with the speculum it has the color of the mucous membrane, but usually bleeds easily. It has a purple tint if it protrudes through the anus and is pinched by the muscle. It may be differentiated from prolapse and intussusception by demonstrating that it is adherent to the wall at only one point; from hemorrhoids by the firmer consistency and, usually, by the long pedicle.

Treatment.—This is surgical. The tumor is tied off at its attachment, close down to the membrane, and excised beyond the ligature. Further treatment is usually unnecessary.

CHAPTER VIII.

DISEASES OF THE DIGESTIVE SYSTEM (CONTINUED).

DISEASES OF THE LIVER.

Anatomy.—The liver in newborn babies is very much larger in proportion to the weight than in adults. It makes up a little over 4 per cent. of the body weight, whereas in adults, it is 2.5 per cent. Normally it extends considerably below the costal margin and can be readily felt. Apparent enlargement of the liver is to be cautiously interpreted, as many things will cause the liver to extend decidedly lower than normal; among these are depressions in the chest wall so often seen in rickets, collections of fluid in the pleural cavity, general weakness and relaxation of the abdominal walls, etc. Diseases of the liver itself are comparatively rare in infancy and childhood.

A gradual decrease in the proportional size takes place throughout childhood, so that by the fourth year it is no longer palpable.

CATARRHAL JAUNDICE.

Definition.—This is a jaundice occurring as an accompaniment of acute inflammation in the duodenum, involving the ampulla of Vater. It is described here because the jaundice is the most striking symptom; in reality it is secondary to the intestinal condition. It is possible that it may occur primarily as an inflammation of the bile duct, but observation on this point is lacking on account of the lack of postmortem examinations.

Etiology.—Its occurrence in babies is exceedingly rare. Over three years it is frequently seen, and is much more prevalent in the fall and early winter. This is so constant that it argues for a specific infection as the cause of the dis-

ease. No other evidence supports this view. Errors in diet act as the exciting cause in a great many cases, these usually being the ingestion of some exceedingly indigestible material. Exposure to cold sometimes is apparently the cause. It may occur in the course of any of the acute infections, especially malaria and influenza.

Pathology.—This is largely presumptive. We assume that it is an extension of a catarrhal inflammation of the duodenal membrane, and this results in a closure of the common bile duct from swelling of the mucous membrane.

Symptoms.—At first there are usually the signs of ordinary indigestion, sometimes with severe pain, vomiting and prostration. The pain is sometimes extremely severe, coming in paroxysms that may simulate early appendicitis; there is then considerable tenderness, nearly always in the region of the duodenum. In other cases the symptoms are not so severe, loss of appetite, nausea, coated tongue, and slight abdominal uneasiness. Sometimes the jaundice comes without the child having been ill enough to complain.

The stools are light in color, and some time during the course of the disease become perfectly white. These white stools may be noticed as the first symptom a day or two before the jaundice. The urine is dark, with a greenish hue, and stains the clothing yellow. If shaken in a tube or bottle, the foam is distinctly greenish yellow, showing the presence of bile pigment. After two or three days the jaundice appears, first in the scleræ of the eyes. It generally comes as a distinct surprise, the condition not being diagnosed before then unless the urine and stool have been examined. With the jaundice there may be considerable itching of the skin. Slowing of the pulse, as noted in adults, is not often seen in children. The only other sign of importance is the enlargement of the liver. This is nearly constant, and may be quite pronounced, the liver extending two inches below the ribs. Sometimes it is moderately tender.

This enlargement of the liver remains long after all signs of illness have disappeared.

Prognosis.—This is good; most cases recover perfectly if let alone without any special treatment. The active illness lasts

about three or four days as a rule. The jaundice will remain for about two weeks, if it has been very pronounced.

Treatment. The diet should be made as free as possible from fat, and the amount of sugar should be reduced decidedly. In fact, the more limited the diet, the more rapid is the recovery. Skimmed milk or buttermilk may be relied upon for most of the needed nourishment; egg albumen, rare meat, and the juice of fruit will make a sufficient variety.

The bowels should be kept well open, preferably by means of some saline. An excellent plan is to give a level teaspoonful of an equal mixture of sodium sulphate and potassium phosphate in a glass of water every morning. There is no limit to the amount of water the child may take. If there is any difficulty about moving the bowels, a copious enema should be given the first day. Severe gastric pain may be relieved by hot applications or turpentine stupes.

A very careful diet should be insisted upon for a week after the acute symptoms have subsided.

FAMILIAL JAUNDICE.

Definition.—This is a little understood form of jaundice that exists throughout a lifetime, is attended by no symptoms other than the icterus, and is presumed to be hereditary.

Etiology.—No reason is known for its appearance. Although rather a rare condition, it has been observed generally in two or more persons in the same family. Its hereditary nature is assured, but no other etiological factor is known.

Pathology.—There is none except the tinting of the tissues with bile pigment. The liver, bile ducts and gall-bladder show no abnormality nor obstruction. The spleen is enlarged, sometimes considerably.

Symptoms.—The jaundice usually makes its appearance in the first few weeks after birth, but sometimes later in childhood, or even in early adult life. It may be very slight and evident only in the eyes; it is never as intense as in a typical catarrhal jaundice. These children are subject to frequent attacks of indigestion and the icterus is apt to increase at

such times. The stools are apt to be darker than normal, but the urine ordinarily does not contain bile pigment.

These children are apt to be not very well nourished, show moderate anemia, and be subject to the digestive disturbances. Otherwise they seem as healthy as the ordinary child and develop in a normal manner. The jaundice persists throughout life.

Treatment.—No treatment has the slightest effect on the jaundice.

FUNCTIONAL DISORDERS OF THE LIVER.

A number of minor illnesses in children seem to be dependent on improper functioning of the liver. They are of frequent occurrence and are so closely associated with general impairment of digestion that they are difficult to classify. Because of certain rather characteristic symptoms they are assumed to be due to impaired liver function.

One class of cases presents evidence of a deficient production of bile, and these are fairly definite in character. Others seem to depend on the imperfect transformation of the nitrogenous substances of the blood, and which is perhaps the result of impairment of the chemical activity of the liver cells; these are little understood, and the part played by the liver is doubtful.

Etiology.—Heredity seems to be the main predisposing factor. Attacks may be precipitated by overeating, indigestible food, undue exposure, or great excitement; habitual lack of exercise is of importance.

Symptoms.—In general these are the same as in chronic indigestion, or recurring attacks of acute indigestion. Headache, coated tongue, foul breath, poor, capricious appetite; constipation alternating with diarrhea. Evidence of poor nutrition and anemia are nearly always present. The evidence pointing to the liver as being at fault is the character of the stools. These are usually light in color, sometimes nearly white, and of a musty, offensive odor. This condition is apt to be more marked during attacks of an acute nature. Flatulence and colic are very common. Sometimes the constipa-

tion is extremely obstinate, and during these times the child is likely to seem quite ill.

The other sort of cases shows marked nervous symptoms of no special variety; they are apt to have sudden uncontrollable outbreaks, for no apparent reason, except perhaps slight indigestion. It has been thought possible that acidosis, migraine, cyclic vomiting, and other obscure conditions may be due to liver derangement.

Treatment. This is directed entirely toward finding the proper diet for the child, and adhering to it for a long time. The sort of food that proves readily digestible must be discovered for each individual. The fats are usually not well digested, and their amount should be curtailed. Starches must be given moderately. Dependance must be placed largely on proteid, and it is necessary to feed these children considerable meat and milk. Cooked fruit, the more readily digestible vegetables, and any other variation that experience shows is well taken care of, may be used. The diet should always be simple, wholesome, given at regular intervals, and never a very large meal at any one time. The child should be made to drink a great deal of water. And regular outdoor exercise should be insisted upon. Such children are best kept from playing exciting games.

The value of any drug is doubtful. Those which possibly aid digestion may be tried, as in intestinal indigestion. Occasional courses of calomel sometimes have a beneficial effect. Phosphate of sodium is recommended to aid the production of bile. It does no harm, and may do some good.

When the above program is carried out consistently, the tendency to the attacks usually entirely disappears.

CONGESTION OF THE LIVER.

This is always secondary to some other condition. The acute form is an active congestion and may be due to a variety of causes; the action of phosphorus or arsenic, in poisonous doses; malaria and influenza infections; the engorgement in catarrhal jaundice, and in acute acid intoxication. None of the symptoms of these conditions, other than jaundice, can be

referred to the liver as the cause, and the diagnosis and treatment are concerned with the primary condition. Acute congestion is not often seen except in acute catarrhal jaundice and acute acid intoxication.

Chronic congestion is much more common, and is usually passive. Most often it is due to venous obstruction in heart disease and in such chronic lung affections as cause enlargement of the right side of the heart from overwork; the most common of these are emphysema, chronic interstitial pneumonia, chronic thickening of the pleura, and retained pleural exudates compressing the lungs.

In chronic passive congestion the liver is very firm, darker than normal, hard and resistant to cutting; if the condition is of long standing, the cut surface is mottled so as to earn for it the name of "nutmeg liver." There is then some increase in the connective tissue, producing a cirrhosis.

Symptoms.—The symptoms of either form of congestion are those of the disease which caused them. The enlargement is, of course, readily made out. It is uniform, the surface is regular; in advanced cases of heart disease with tricuspid insufficiency it may be felt to pulsate. Sometimes there is slight jaundice; also disorders of digestion that are due to the hepatic insufficiency.

The liver is rarely much enlarged from other causes in childhood, but the possibility of hypertrophic cirrhosis, leukemia, solitary tubercles, and the possibility of some collection of fluid in the pleura pushing the liver down must be borne in mind.

Prognosis and Treatment.—The prognosis and treatment depend entirely on the primary condition that produces the congestion.

The congestion itself is often somewhat relieved by the frequent use of saline cathartics, with a relatively dry diet.

HEPATIC ABSCESS.

Definition.—This consists in the localization of pus in the substance of the liver. There are two varieties: in one there is a single circumscribed abscess, to which is due the constitu-

tional illness; in the other there are multiple points of suppuration, and there is then usually other illness to which this condition is secondary. Both forms are rare in children.

Etiology. Infection through the portal vein, from some infection elsewhere, is the most common cause. Most often this is pylephlebitis resulting from appendicitis. It may be from gastric or duodenal ulcer, typhoid or tuberculosis. Traumatism, in which the liver is punctured or ruptured, is a less frequent cause. Rarely suppuration of adjacent organs, gall-bladder, kidney, lung, may be the cause. Occasionally it occurs by way of the biliary ducts, generally from migrating round-worms. Amebic dysentery is a rare cause in this country. Multiple abscesses may result from a general pyemia.

Pathology. This is the same as that of an abscess anywhere except that the contents are so characteristic that the fluid has been called "liver pus." It is dark in color and usually contains material of different colors; the odor is apt to be extremely offensive. The larger abscesses are generally near the surface and there is an area of perihepatitis about them.

Symptoms. The signs pointing to involvement of the liver are enlargement of that organ, tenderness in that area, and abdominal pain, not often referred to the liver itself. The most constant constitutional symptom is a succession of chills, with sharp rise of temperature, followed by sweating; this is the so-called "hectic fever," and it may recur day after day, or at almost any interval, with or without the chill. Other symptoms are vomiting, diarrhea, and progressive prostration. Jaundice is usually moderate and inconstant, occurring in less than half the cases. As the disease progresses the signs of illness become very pronounced; stupor or delirium, continuous fever, sharp chills, and rapid emaciation. There may be suspicion of involvement of the right lung if the abscess is high up in the right lobe, such as cough, diaphragmatic pleurisy, dyspnea from pressure. Rarely the abscess ruptures into the pleural cavity.

In the tropical or amebic abscess the symptoms are less marked; they may be latent for a considerable time. Often the abscess is discovered postmortem when it was not sus-

pected in life. The symptoms are much the same but less marked and of longer duration.

Diagnosis.—This is only positively made by aspirating and obtaining the typical pus. This should never be done without making preparation for immediate operation if the pus is encountered.

Prognosis.—In the multiple abscesses of pyemia this is almost always very bad. In the single variety the outlook depends entirely on the time of diagnosis and operation. The chances of recovery without operation are very slight. If the abscess is readily accessible, the prospect is good if the patient is in good condition.

Treatment.—This is entirely surgical and need not be gone into here. Cases of recovery have been reported from simple aspiration of the pus; this is an extremely irrational procedure and a cure by this means should not be attempted.

FATTY LIVER.

This is a condition in which the liver is engorged with fat. It may be a simple infiltration of fat in the lobules, or a degeneration of the hepatic cells with the formation of fat; usually there is some degree of both, but the infiltration is the more marked.

The liver is enlarged, pale, soft, the surface smooth, and the specific gravity much less than normal; the knife with which it is cut is covered with oil droplets. Under the microscope the fat is seen invading the lobules everywhere, and usually some, or many, hepatic cells show the transformation into fat.

As far as is known the condition is always secondary to some chronic, wasting disease, particularly tuberculosis, gastro-intestinal disease, marasmus, etc. Many times it is observed in fairly well-nourished infants. It is a very common postmortem condition in infants dying from any cause, and its importance in lessening the liver function is unknown.

Symptom.—The only symptom during life is the enlargement of the liver, which may be readily demonstrated. The

enlargement is uniform and there is no pain or tenderness. The diagnosis is made only by inference, as there are no signs pointing to improper function of the liver.

Treatment. The treatment is entirely that of the original disease, whatever that may be.

AMYLOID LIVER.

Definition.—This is a peculiar condition in which there is deposited an amyloid substance between the capillaries and the hepatic cells, causing degeneration and atrophy of the cells by pressure. It is also referred to as waxy or lardaceous liver.

Etiology.—The condition in the liver is usually associated with a similar condition in the kidneys and spleen, and in children it is practically always due to prolonged suppuration; this is often due to chronic infection of the bones or joints, chronic tuberculosis, syphilis or empyema.

Pathology.—The liver is very much enlarged, regular, smooth, of a waxy, gray color. On section it has a glistening appearance and it cuts with some difficulty. Iodine gives a brown color to the amyloid material, hence its name.

Symptoms.—There are no special symptoms to be referred to the liver itself; if very large, there may be moderate ascites. In the presence of a condition of long-continued suppuration, a much enlarged, very firm liver, with no pain, tenderness, jaundice, or abnormal stools, will usually be found to be waxy. Any other symptoms that may be associated with the enlargement cannot be said to be due to the liver. The spleen is regularly enlarged; the kidneys are involved also in nearly every case, and the urine will show the characteristic waxy casts.

Prognosis.—This is bad, principally because of the chronic, stubborn nature of the original disease; if that can be overcome the condition of the liver offers no obstacle to recovery unless the involvement is extreme.

Treatment.—This is concerned entirely with the disease causing the trouble. Nothing else will have the slightest effect on the liver.

CIRRHOSIS OF THE LIVER.

Definition.—This is a condition in which there is a marked increase in the connective tissue of the liver, usually with more or less destruction of the liver cells. Occasionally there is cirrhosis in long-standing cases of "nutmeg liver," due to passive congestion. Otherwise there are two general varieties, portal and biliary.

Etiology.—Cirrhosis is a rare disease in children. Portal cirrhosis is common in adults and very rare in children; biliary cirrhosis is very uncommon in both children and adults, but is relatively more frequent in children ten or more years of age.

Alcohol is nearly always the cause of portal cirrhosis. When it occurs in children, it can hardly be said to be due to the abuse of alcohol, but this may sometimes be known to be the case. It is probable that any slow-acting poison that constantly gains access to the portal circulation may cause this cirrhosis, be it from infection, intestinal absorption, or anything else. The cause of biliary cirrhosis is even more obscure. The poison here acts through the biliary passages, and from the frequent association of fever and other symptoms pointing to infection, it seems possible that an active, prolonged infection may be the cause. The more it is studied, the less is the inclination to ascribe the cause to any specific infection, as malaria, syphilis, tuberculosis, etc.

Pathology.—In the portal form the liver is somewhat enlarged; it is rarely smaller than normal, and the older term of atrophic cirrhosis does not exactly distinguish it from hypertrophic or biliary cirrhosis. The surface has a yellow color and is distinctly granular, the "hobnail" liver; it is firm and cuts with difficulty, due to the great increase in the connective tissue. The liver cells are in various stages of degeneration or necrosis, the amount depending on the advanced state of the disease. The connective tissue is largely distributed in the portal spaces and around, not within, the lobules.

In the biliary form the liver is always enlarged, sometimes very much, but often no more than in the portal form. The surface is a dark greenish color, smooth and regular, and the

consistency increased. The cut surface is dark yellowish-green in color, slightly granular in advanced cases, and the lobules are plainly seen. Microscopically, the connective tissue is seen to be increased within the lobules; but the important condition is an obstruction of the small bile ducts by proliferation of the lining epithelium.

Symptoms.—These differ so widely in the two forms, and vary so greatly in the same form in different cases that it is impossible to describe them thoroughly here; for detailed description one is referred to a treatise on medicine. Only the striking symptoms are here mentioned.

Portal cirrhosis in the early stages presents the symptoms of a gastro-intestinal catarrh, coated tongue, anorexia, flatulence, constipation alternating with diarrhea. Later vomiting, hematemesis, and blood in the stools are noted; followed by ascites, large spleen, progressive loss of weight and strength. Jaundice is slight or absent. The liver is almost always larger than normal and is often tender. The disease usually exists for a long time before the active symptoms manifest themselves.

In the great majority of cases the first symptom of biliary cirrhosis to attract attention is slight jaundice. It progresses irregularly, and with it the itching and eczema that go with severe jaundice. There is bile pigment in the urine, sometimes bleeding from the nose and gums: the feces are quite dark. Frequently there are attacks of severe abdominal pain, fever, and increase in icterus.

Other symptoms are much the same as in the other form, except that ascites is rare. The liver is much enlarged and this may have been noted by the patient or the parents; it is rarely tender. The spleen is very much enlarged, and in children particularly it is apt to be extremely large—even larger than the liver. Emaciation, weakness and prostration gradually develop, and the case terminates with coma or delirium.

Prognosis.—This is bad, and in children death usually takes place within a few months after the diagnosis has been made. The biliary form is usually more rapidly fatal.

Treatment.—This is largely symptomatic. Evidences of portal congestion are the indication for hydrogogue catharties.

The diet should be bland, and milk is to be relied upon for most of it. Moderate exercise, warm baths and plenty of water are necessary. Ascites is relieved by tapping when pressure is extreme. For the cure of the disease itself there is no known remedy.

HYDATIDS OF THE LIVER.

(Echinococcus Disease.)

Definition.—This is a cyst or collection of cysts in the tissue of the liver caused by the growth and proliferation of the embryo of Tenia echinococcus.

Etiology.—It is a very rare condition in the United States, and especially so in children. It is contracted by swallowing, with the food or drink, the eggs of a small tape-worm, the echinococcus. This worm inhabits the small intestine of dogs and the disease is more common in localities where dogs are closely associated with men, *i. e.*, Iceland. In the human intestine the covering of the egg is dissolved, the embryo liberated, and access gained to the portal vein by boring into one of its branches. The embryo lodges in the liver and there becomes a cyst. The growth then proceeds by the development within this "mother cyst" of other similar "daughter cysts;" of these there may be a few or hundreds. They are pale, translucent, bladder-like bodies; in the interior they always contain hooklets and scolices by which a certain diagnosis can be made. In size the cyst varies from a pin-head to as large as a child's head.

The cyst may shrink and be ultimately calcified through death of the embryo; it may become infected and result in an abscess; or it may rupture, produce hydatids elsewhere, or cause death from collapse.

Symptoms.—The cyst gives no symptoms for a long time, sometimes being unexpectedly found at autopsy. The first symptoms are usually due to mechanical pressure. Growth is very gradual and the increase of pressure is also gradual. There is a sense of weight and dragging in the region of the liver; there is no pain nor tenderness. Jaundice occurs only from pressure of large biliary ducts; ascites from obstruction

of the portal vein. Dyspnea occurs from upward pressure on the lungs; cardiac disturbances from similar pressure. If infection occurs, the symptoms of hepatic abscess are seen. Rupture may occur into the peritoneum, the pleura, lung, stomach, vena cava, or any neighboring structure, and the symptoms are then referred to the structure invaded.

The liver is enlarged, usually irregularly. If the cyst is very superficial, the "hydatid fremitus" may sometimes be felt by placing one hand over the liver and gently tapping the liver with the other. Positive diagnosis is made by finding scolices in the fluid, wherever the fluid is encountered.

Prognosis.—Spontaneous recovery is unlikely after the cyst is large enough to produce symptoms. Recovery then often occurs after operation. With spontaneous rupture the outlook is bad. Infection is extremely serious.

Treatment.—No medicinal treatment is of avail. Recovery depends entirely on surgical measures. In some cases puncture and tapping have resulted in cure. This procedure should be very cautiously performed.

BILIARY CALCULI.

Definition.—This is the presence in the bile passages of concretions that cause mechanical irritation and obstruction.

Etiology.—Gall-stones are extremely infrequent in children. The majority of cases occur in the first few months of life.

They are nearly always caused by the precipitation of cholesterin from the bile, this acting as a nucleus for the accumulation of inspissated bile, mucus, and other material. The essential factors are a mild, catarrhal inflammation of the biliary mucous membrane, combined with slight obstruction to the flow of bile.

Pathology.—There may be a single stone; usually there are more. They are usually small, and if they are closely packed in the gall-bladder, they are faceted from mutual pressure. They are rather soft and friable, of a dark brown color, usually showing the nucleus of cholesterin. They are usually found in the gall-bladder, but may be present in any portion of the biliary tract. The mucous membrane of the bladder, or

of that portion of the passages which contains the stone, is the seat of a moderate catarrhal inflammation. Complications consist of added infection and suppuration, complete obstruction of the passage, ulceration into neighboring organs (usually the duodenum), or extreme dilatation of the gall-bladder without infection.

Symptoms.—The so-called biliary colic is the most characteristic symptom. This is due to the passage of a small stone through the duct. The attack begins suddenly, with sharp, agonizing pain in the right hypochondrium; the pain radiates around the chest, or up the right scapular region. The child cries sharply and rolls around the bed. The screaming is incessant, and nothing but morphin will relieve the pain. The skin is pale, moist, and the appearance one of severe prostration; vomiting soon begins. Usually there is a sharp rise of temperature in a few hours, preceded often by a chill. In highly neurotic children there may be convulsions. After a day or two jaundice usually appears, with the bile-colored urine and white stools. This is not a necessary accompaniment of an attack.

On examination there is sensitiveness and rigidity over the liver, and it may be enlarged; there is sometimes enlargement of the gall-bladder.

Following the attack of colic there may be a complete subsidence of symptoms from the passage of the stone into the duodenum. If this does not occur, the stone may become impacted in the cystic or the common bile duct. If it remains in the cystic duct, the gall-bladder becomes much distended; if this is gradual, it may cause no pain. It does not cause jaundice or any other symptoms of bile obstruction. If infection occurs, there results an empyema of the gall-bladder with marked symptoms. If infection does not occur, the fluid may become inspissated and the bladder atrophy. These latter results are very rare in children.

If the stone becomes impacted in the common duct, the pain gradually ceases or becomes intermittent. The jaundice persists or increases. Later there is usually a passage formed around the stone, the bile escapes, and the symptoms of obstruction disappear. Such an impacted stone may cause

no trouble, but there is always danger of acute infection resulting, which may spread to the liver.

Diagnosis.—Sudden, severe pain in the region of the liver, often radiating to the right scapula, associated with evidence of bile obstruction, slight tenderness with perhaps enlargement of the liver, are the prominent points in diagnosis. The possibility of simple colic, appendicitis, intussusception, intestinal perforation, etc., must be considered, though the appearance of jaundice should differentiate from these. The concretions may be found by careful search in the stools after an attack of colic.

Prognosis.—The attack itself is rarely fatal. One attack is likely to be followed by others. Cases with suppurative inflammation are very serious.

Treatment.—When the diagnosis is assured the pain must be relieved by morphin. In this connection it must be remembered that children bear opium poorly, but sufficient must be given to relieve the pain. Hot stupes, sprinkled with chloroform, may relieve the pain to some extent, and should be used particularly where the diagnosis is in doubt.

After the attack the treatment should be directed to preventing the formation of stones. The most important thing is the drinking of just as much water as the child can possibly take. The diet should be regulated, should be very simple, easily digested, fats made as scanty as possible and the amount of sugar decreased. Lots of outdoor exercise is beneficial, though it should not be violent. Occasional free use of saline cathartics, particularly phosphate of sodium, is helpful.

Recurrences should be treated by surgical operation. Any complication that may arise is best seen with a surgeon.

DISEASES OF THE PANCREAS.

ACUTE PANCREATITIS.

This disease is so excessively rare in children that it is needful only to mention it here that it may be considered as a

possibility in cases of sudden, acute, obscure pain in the upper abdomen.

It is difficult to differentiate from other acute abdominal conditions. The onset is very sudden with sharp, often excruciating pain above the umbilicus, usually without fever. Vomiting is nearly always present, usually copious and stained with bile. In severe cases the symptoms rapidly progress, weakness becomes pronounced, evidences of shock appear, and the patient may die in a few hours.

Examination shows marked rigidity of the abdomen and some distention, but no other signs that can be relied upon.

Hemorrhage into the pancreatic tissue occurs so often in the early stage of the disease that it has been called acute hemorrhagic pancreatitis. This may be the only lesion. When the condition lasts a number of days there is usually gangrene of a portion of the pancreas, and it is then called gangrenous pancreatitis.

Treatment.—Treatment during the acute stage is symptomatic. If the patient survives this stage, surgical interference may effect a cure.

PANCREATIC CYST.

This condition is also very rare in children, but occurs with greater relative frequency than acute inflammation.

Etiology.—There are two varieties—true cysts due to blocking of one or more ducts with retention of the secretion, and pseudocysts occurring from trauma of some sort and having a wall of connective tissue. Only the larger ones can be recognized clinically.

Symptoms.—The most valuable symptom is the presence of a fluctuating tumor in the epigastrium situated more to the left than the right, and associated with considerable pain. Other symptoms are those of pressure on various organs; gastric distress, indigestion, etc., when the stomach is interfered with; jaundice by pressure on the hepatic duct when the tumor is in the head of the pancreas. Rarely does the urine contain sugar. Positive diagnosis can be made by ex-

ploratory puncture and aspiration; this is a procedure to be performed with the greatest caution.

Treatment. This is purely surgical.

DISEASES OF THE SPLEEN.

Anatomy. The normal spleen of a child lies with its convexity against the diaphragm on the left side, behind and to the left of the stomach, and extending across the ninth, tenth, and eleventh ribs. When of normal size and in normal position, it cannot be felt by external manipulation, and it is difficult or impossible to outline it by percussion. If sufficiently enlarged, the lower edge can be felt below the costal margin; moderate enlargement often may be made out by feeling the spleen descend during deep inspiration. The only sign evident to us in abnormal conditions of the spleen is its enlargement.

Sometimes the spleen is not held firmly to its position. It may then be found in almost any location, and is referred to as "movable spleen."

The spleen is subject to various changes, due to inflammation, infarction, congestion, cirrhosis, etc. The symptoms are always those of the primary disease which is located elsewhere than in the spleen. Rare exceptions to this are primary tumors or cysts of the spleen itself.

Enlargement.—This is extremely common in children. Very often a young child is examined and found to have a readily palpated spleen when there are no evidences of illness, malnutrition, or any known preceding illness.

Acute enlargement is most often due to malaria, typhoid fever, and septicemia. Any of the acute infections may cause considerable enlargement. Such a swelling is due to congestion and the spleen is soft, symmetrical, and very dark in color. If the infection completely disappears the spleen usually returns to normal.

Chronic enlargement also occurs frequently. The com-

monest causes are rickets, syphilis, tuberculosis, and many chronic disorders. The most extreme enlargement is seen in splenic leukemia and other blood diseases, and chronic malaria. The spleen is then firm, resistant, and the edges (sometimes the notch) easily felt. There is hyperplasia of the pulp, increase in the trabeculæ, and sometimes thickening of the capsule.

Enlargement is usually readily made out. If the edge does not extend below the ribs, it may often be felt to descend during deep inspiration. This is aided by having the child lie on the right side with the legs drawn up; then pushing the fingers lightly under the costal margin and having the child take a deep, slow breath.

GAUCHER'S DISEASE.

Enlargement of the spleen so decided as to merit the term splenomegaly occurs in a variety of obscure conditions, splenic anemia, leukemia, cirrhosis, etc. But there is a type of primary splenomegaly which occurs in children that is apparently a definite disease with well-defined symptoms and pathology. It was first described by Gaucher in 1882, and his name is now given to the disease.

Etiology.—Nothing is known of this. It has frequently been noted that it is present in two or more children in the same family, but there is no hereditary influence manifested in other ways.

In most cases it appears before ten years of age, sometimes in infancy; it may begin in adult life. Girls are much most commonly affected.

Pathology.—Most striking is the great enlargement of the spleen which is sometimes enormous. It is smooth and regular and quite firm. The liver is always enlarged, sometimes very much, being also symmetrical. The lymph nodes are enlarged, but often only those in the abdomen and thorax. All these organs, and the bone-marrow, show typical microscopic changes due to the presence of large oval or round cells with from one to four relatively small nuclei with peculiar staining characteristics. The other tissues show degenera-

tion or necrosis of varying degree and nearly always there is a pigmentation of the splenic pulp. The liver shows very

FIG. 9.—Gaucher's disease. Showing the very large spleen and enlarged liver. There are a number of purpuric spots on the thighs and legs. (St. Louis Children's Hospital.)

marked connective-tissue increase and scattered pigmentation. Other organs and tissues show nothing characteristic except the pigment.

Symptoms.—The onset is so slow that it is not perceived, and the first thing to attract attention is the large spleen, or slight pain or discomfort in the splenic region. Then palpation shows a large, firm spleen, large liver, and a peculiar yellowish-brown discoloration of the skin on those parts exposed to the light. This is not jaundice. The conjunctiva shows a thickening on one or both sides of the cornea, rather wedge-shaped, and with the same discoloration as the skin. There is generally some bleeding from the gums, mucous membranes, and often under the skin. There is a persistent leukopenia, sometimes as low as 1000 per c.m. Rarely myelocytes are present. There is no marked diminution of the blood cells and the hemoglobin is usually not much reduced, though it is relatively lower than the cell count.

Subjective symptoms are not common and usually consist only of abdominal discomfort due to the large spleen and liver. This lack of symptoms is a remarkable feature of the disease.

Diagnosis.—The above symptoms, with the lack of ascites, jaundice, emaciation, anemia, and other marked symptoms of other diseases, should serve to easily separate from leukemia, cirrhosis of the liver, splenic anemia, etc.

Prognosis.—The disease does not seem to be a fatal one in itself. Usually the subjects die of some intercurrent disease, and perhaps the general resistance is lowered. It has an essentially chronic course, lasting for twenty or more years.

Treatment of Diseases of the Spleen.—Inasmuch as splenic enlargement is usually secondary to some other disease there is no treatment directed to the spleen itself, and none is known to be of any benefit. Tuberculosis, syphilis, and other conditions, affect the spleen as a part of a general process, and the treatment is general.

Medical treatment of Gaucher's disease is of no avail. In some cases splenectomy has been done with remarkable improvement. As no other treatment is of any avail, it is well to consider operation in every case. But the fact that the disease is not confined to the spleen makes this a doubtful procedure in many cases.

DISEASES OF THE PERITONEUM.

ACUTE PERITONITIS.

Definition.—This is an acute inflammation of the serous membrane lining the viscera and the wall of the abdomen. The inflammation may be local, confined to one small area of the peritoneum, such as the neighborhood of the appendix or gall-bladder; or general, involving the whole peritoneal cavity. A localized peritonitis is liable to become general.

Etiology.—Acute peritonitis occurs quite commonly among newborn infants, occurring even during intra-uterine life. In the newborn it is usually due to streptococcus or staphylococcus infection from the navel.

In later childhood the common causes are appendicitis, perforation of the intestines in ulceration from typhoid fever, etc., and as a complication of erysipelas, pneumonia, perinephritic abscess, gonorrhea or empyema; any infection of organs in or adajcent to the peritoneum may be the cause. Traumatism, surgical operations, strangulated hernia, or intussusception may cause it. Cases occur, usually after unusual exposure to wet or cold, which can be accounted for in no other way; and certain so-called idiopathic cases occur without ascertainable cause.

Pathology.—In the beginning the peritoneum is congested, the surface dull and lustreless, and the subperitoneal vessels visibly enlarged. Soon the surface becomes roughened and an exudation of serofibrinous material or of pus takes place. The surface of the membrane here and there shows fibrinous patches and these cause adhesion of the peritoneal surfaces to one another; usually portions of the intestines become adherent to themselves or to other organs. Sacculated collections of pus may thus be formed. There may be considerable quantities of exudate formed and the evidence of free abdominal fluid obtained. The intestinal walls are often paralyzed, with obstipation and great distention.

If recovery ensues after such an attack, the adhesions become organized and permanent; by this means adjacent organs may be permanently adherent, bands of adhesions may

constrict the intestines, and many unfavorable results ensue. These adhesions are often the means by which the infection is walled off and kept localized, thereby saving the life of the patient.

Symptoms.—With a localized peritonitis these are related to the structure primarily involved, as the appendix, kidney, etc. Signs of involvement of the peritoneum are increased pain, rigidity of the muscles in the locality, and rise in temperature and increased leukocytosis.

In general peritonitis pain usually begins suddenly, without any warning. It is usually localized in the inflamed area, but often is irregular, first one place and then another; soon it becomes general. The abdomen is very rigid and extremely tender; all motion, even that of breathing, increases the pain; on this account respiration is apt to be entirely costal. The patient lies on the back with the knees drawn up to relax the abdominal wall as much as possible. Vomiting begins early and is quite intractable. The bowels are usually very constipated, not even gas being passed, and the distention of the abdomen is marked and rapidly increases. The face shows rather a typical haggard anxiety with marked pallor and staring eyes. The pulse is rapid, feeble, and wiry; the respiration superficial, rapid, and costal in character. The tongue is coated and dry, thirst is incessant and agonizing.

The temperature is extremely irregular and of no diagnostic value. There is always some rise during the disease, and it may range from subnormal to 105° F. at different times. There is always some leukocytosis, sometimes quite high. This is a valuable sign in differentiation at times.

The mind is clear, usually to the last. Infants are apt to develop convulsions.

In the severe forms the course is rapid, prostration develops early, all symptoms are very marked, and death occurs in a few days. If the condition becomes localized in one or more places, the symptoms slowly subside and there are present the evidences of abscess, with irregular fever, sweats, perhaps tumor, etc.

Diagnosis.—The symptoms are so striking that in most cases it can hardly be mistaken for anything else. It always pre-

sents the evidence of a serious disease, and is on that account not apt to be confused with simple colic or acute indigestion; later symptoms will always differentiate it from these. It may be confounded with intestinal obstruction, but the fever, distention with rigidity, breathing, etc., should clear it up at once. The previous illness often will suggest peritonitis, being usually appendicitis, typhoid fever, or other infection.

It is important to know the cause of the peritonitis. Surgical entrance to the abdomen will be influenced by the probable point of original infection. Very often the original site must be disregarded even if it is known.

Prognosis.—Diffuse general peritonitis has been until quite recently regarded as nearly hopeless. With the aid of a number of procedures the mortality had been steadily decreasing. Nearly half of the cases now recover under early treatment. In infants this does not apply, as the disease is then nearly always fatal.

Localized peritonitis is not in itself often fatal. It results in death from extension to the peritoneal cavity, from general sepsis, or weakness and exhaustion through prolonged neglect or incorrect diagnosis. Opening and draining the abscess cavity nearly always results in a cure of that particular condition.

Treatment.—In the great majority of cases immediate surgical intervention is imperative. Surgical aid and advice should be insisted upon in every case. The surgical aspects of the treatment need not be considered.

Medical measures consist of absolute rest with as little movement as possible. If cold applications are tolerated, they should be kept constantly applied. Hot applications for the relief of pain and distention may be used when cold is resisted. Hot turpentine stupes constitute a good means for applying heat.

The diet, the use of purges, any treatment of the various symptoms, should be used only after the surgical status of the case has been settled. Food is likely to be immediately vomited and it should be of the simplest character—milk, raw egg, liquid peptonoids, koumyss, etc. The best means of combating the vomiting is washing the stomach once or more

daily, before feeding; small doses of opium may be used before the food is given. Cracked ice and champagne is sometimes helpful, and also aids in relieving the terrible thirst. The use of purges is a matter requiring the most delicate judgment. It seems most rational not to use them at all because of the increased movement of the intestines that inevitably follows. This should be a matter for the surgeon to determine.

Morphin or opium is often necessary to control the pain. They must never be used until the diagnosis has been determined, as they obscure the symptoms by making the patient comfortable. Thereafter they are often valuable if used judiciously, as they not only relieve pain but quiet intestinal peristalsis and help to limit the process. If the diagnosis is made very early, the immediate use of opium may be of great value. Either should be given in full dose, sufficient to entirely relieve the pain and quiet the intestines.

For a five-year-old child it is best to use $\frac{1}{20}$ grain of morphine hypodermically, repeating in one hour if no relief is obtained; $\frac{1}{300}$ grain of atropine may be combined to aid in quieting intestinal movement, but it should not be repeated with subsequent doses of morphin.

The introduction of a rectal tube, which is allowed to remain in place, will sometimes assist in relieving the distention by the escape of gas. Water introduced into the colon by the drop method will aid in relieving thirst and promoting elimination.

The Fowler position, with the head raised by means of raising the head of the bed and giving a downward slant to the body, is advisable for limiting the process to the lower portion of the peritoneum.

Stimulants, particularly alcohol, digitalis and strychnine, are to be used as indicated.

CHRONIC PERITONITIS.

Definition.—Any chronic peritonitis other than tuberculous is very rare in children. It consists of long-continued in-

flammation of the peritoneum without the production of acute symptoms.

Etiology. It often follows an attack of the acute variety; more often no reason can be assigned for it. It occurs practically always in children over six years. New growths of the liver or kidney may be associated. It is directly comparable to chronic pleurisy, in which there is often effusion, and in which the cause often cannot be determined.

Pathology.—This consists, in the majority of cases, of the presence of a serous or serofibrinous exudate in the peritoneal cavity. Here and there there is thickening of the peritoneum, often with edema. Weak adhesions are formed between portions of the intestines, or the intestines and other organs. Very often there is chronic pleurisy associated.

Symptoms.—These begin very gradually, with some interference with the general health, slight digestive disturbances, and irregular colicky pains in the abdomen. General abdominal pain is slight or lacking, and there is usually little tenderness. There is usually constipation, anorexia, slowly progressing anemia and weakness, none of which are marked. There is generally no fever.

The symptom to attract attention is the enlargement of the abdomen with the evidences of free fluid. The abdomen slowly increases in size, the umbilicus protrudes, the veins become prominent, and the wave of fluctuation is readily obtained.

Diagnosis.—This cannot be made until the presence of fluid is ascertained. Then other causes for the ascites must be excluded, as chronic heart disease, portal obstruction, and particularly tuberculous peritonitis; differentiation from the latter may be impossible, except by the further course of the disease.

Prognosis.—This is usually good as to recovery. Often some permanent disability remains, generally due to adhesions. Some cases gradually grow worse in spite of treatment and die of exhaustion and weakness, or of some intercurrent disease.

Treatment.—The child should be kept at rest, preferably in bed, with plenty of fresh air, sunshine, and the best hygienic

surroundings. General tonic treatment, with forced feeding of easily digested and nourishing food, constitute the only measures of much value. Daily, watery bowel movements should be induced by the use of mild saline cathartics.

If the fluid continues to increase and the child shows distress from its presence, the abdomen should be tapped. This may be repeated if the fluid reaccumulates. Sometimes this fluid will show that the case is tuberculous when that disease had not been suspected. After the failure of repeated tappings, it is justifiable to resort to laparotomy.

TUBERCULOUS PERITONITIS.

Definition.—This is an infection of the general peritoneum by the tubercle bacillus.

Etiology.—It is a comparatively common condition in children and occurs most often in early childhood, from the second to the sixth year. Rarely the peritoneum is the only structure involved, but in the great majority of cases there is found infection elsewhere in the body, the intestines, lymph glands of the mesentery, pleura, lungs or other distant parts. Falls or blows on the abdomen in some cases seem to have been the cause for the invasion.

Pathology.—When the peritoneum is involved in the course of an acute tuberculous process elsewhere the only pathology consists in the presence of great numbers of miliary tubercles on the peritoneum. This condition has given no symptoms by which it could be recognized during life. Sometimes this same condition exists and is discovered at autopsy in children who have died of some other disease.

Of the chronic form there are two varieties—the ascitic and the fibrous. In the ascitic form there are great numbers of tubercles all over the peritoneum, here and there grouped together to form distinct masses. There is some roughening and congestion of the serous surface, but usually very slight fibrinous exudation. A large amount of serous fluid is present, but rarely so much as to give very distinct signs of fluid.

The fibrinous form is distinctive because of the great thick-

ening of the peritoneum, the matting together of the intestines, mesentery and adjacent organs, and the presence of more or less serofibrinous exudate. The thickening and adhesions sometimes produce firm tumors, readily palpable through the abdominal wall. Tubercles are present but they may be difficult to find because of the thick exudation. The lymph glands are often tremendously swollen, soft and caseous. The process is a more chronic one than the ascitic. The fluid is often encapsulated by adhesions, forming cystic tumors.

Symptoms.—The ascitic cases are usually the more rapid. There is slight fever, very irregular, evidences of indigestion, gradual weakness, and perhaps some abdominal distress. The abdomen slowly enlarges, first from gaseous distention and later from the accumulation of fluid; this may be the first evidence of any trouble. Vomiting does not often occur, pain and tenderness are slight or absent. As the disease progresses the child feels sick and languid, the fever is more persistent and weakness and emaciation are noticeable.

In the fibrous form the development is even more gradual. During considerable time the general health may remain very good, and the enlargement of the abdomen be the first symptom. This is much more apt to be the case than in the ascitic form. The diagnosis is made by feeling the masses in the abdomen. These may give the abdomen an asymmetrical appearance, be located in any quarter, and usually there are more than one. Dulness is found over these masses, surrounded by tympany. The presence of fluid is not readily determined. These masses, and adhesions constricting the intestines or vessels, may give rise to diarrhea or other disturbance of intestinal function, to edema from pressure on the vena cava, to albuminuria, all with an increase in the general symptoms.

The disease is remarkably subject to remissions, with subsequent increase of symptoms. Sometimes it is discovered at autopsy without having given any abdominal symptoms. Cases undoubtedly have recovered. If softening and breaking down of the tissues occur, there are sudden, well-marked symptoms of serious illness. This is either due to general

tuberculous invasion, or to a rapid involvement of a great portion of the peritoneum. There is diarrhea, considerable fever, weakness, emaciation, all of which progress until death. This may occur from exhaustion in a number of months, or from meningitis, tuberculous pneumonia, or other distant process in the course of a few weeks.

Diagnosis.—Conditions likely to be confounded are rare in children. Cirrhosis, heart disease, and chronic nephritis offer little difficulty. From simple chronic peritonitis it is differentiated by the masses in the abdomen, the slight fever, the positive tuberculin test, and the history. As a rule, in children the presence of ascites associated with fever, having a protracted course, is almost certain to be tuberculous peritonitis. The fluid obtained by tapping is not characteristic; the bacilli cannot be demonstrated in it except by animal inoculation.

Prognosis.—Cases of both varieties do undoubtedly recover, but rarely in infants. The older the child, the better the outlook. The existence and nature of other tuberculous processes must be taken into consideration. The unfavorable cases are those with rather sudden attacks of pain, fever, etc., showing the probability of breaking down of the tuberculous material. It is always a serious disease.

Treatment.—The constitutional treatment is the same as that of any tuberculous process; forced feeding of nourishing, easily digestible food, abundant fresh air, and complete rest. The use of creosote has nothing but experience to recommend it, but it does undoubtedly seem to do good in many cases, improving the appetite sometimes decidedly; it should be tried if it is well borne. No local applications have the slightest effect; nor does tapping.

Laparotomy should be performed on those cases that are steadily getting worse under other measures. The most favorable are those with ascites. The procedure seems irrational, but many recoveries are reported from opening the abdomen, washing well with salt solution, and closing again without drainage. The operation should be performed when there is doubt as to the diagnosis.

The therapeutic use of tuberculin in these cases has never

proved of consistent value. The reports have been decidedly conflicting. There is apparently no contra-indication to its intelligent use, and prolonged trial should be still given it.

ACUTE CIRCUMSCRIBED PERITONITIS.

Inflammation of any organ adjacent to the peritoneum may involve that portion of the membrane and become localized by adhesions. The appendix, colon, gall-bladder, the kidneys or lungs and pleura may be the origin of the disease, and the condition takes its name from the adjacent organ, *i. e.*, appendiceal, perinephritic. But the one that it seems necessary to describe here is that located between the liver and diaphragm, the so-called subphrenic abscess.

Subphrenic abscess may result from suppurating appendicitis; this is the most frequent cause. It may come from a superficial abscess in the liver, perforated gastric ulcer, an antecedent empyema, or from an acute pneumonia with pleurisy. When secondary to ulceration of the stomach or colon, it may contain air, and be mistaken for a pyopneumothorax. Frequently it is mistaken for empyema—in fact the differential diagnosis is difficult.

Diagnosis.—The diagnosis is always difficult and not infrequently impossible, on account of the reference of symptoms to the adjacent organs, or because of the lack of local symptoms. It is not very common in children. The usual signs of suppuration exist. With them there is dulness at the base of the lung on one side with lessened breathing and lack of fremitus. There may be bronchial breathing above from compression of the lung. The abscess is usually on the right side. The liver is pushed down, and there may be abdominal pain, rigidity of the right side, and symptoms of abdominal distress. These are less constant than the thoracic signs.

The most valuable point in diagnosis is through the *x*-ray. By this the diaphragm is seen to be pushed up and no excursion is noticed in breathing.

Treatment.—Treatment is entirely surgical.

CHAPTER IX.

DISEASES OF THE DIGESTIVE SYSTEM (Continued).

DISEASES OF THE MOUTH.

Herpes Labialis. -This is the familiar "cold sore" or "fever blister" that occurs so commonly with coryza. Its chief importance lies in its frequent occurrence in pneumonia, malaria, and epidemic meningitis, sometimes aiding in the diagnosis of these conditions.

If kept from rubbing, picking, or moistening with the tongue, it heals readily without treatment.

Perléche.—This is an ulcer, formed from a fissure beginning usually at the angle of the lips, and kept constantly sore and irritated by licking with the tongue—whence its name. It often resembles the mucous patch of syphilis. It should be touched with alum or silver nitrate and kept well protected with stiff paste of zinc oxide and vaseline.

Geographical Tongue.—This is a proliferation of the epithelium of the tongue which results in a very irregular central area surrounded by the red, unaffected portion, giving an appearance similar to that of a map. It occurs as a manifestation of the so-called exudative diathesis of Czerny, and has no other significance. It lasts for many months, and needs no treatment.

Epithelial Desquamation. — This is the reverse of the above condition, in which areas upon the dorsum of the tongue are denuded of epithelium in irregular patches which change from day to day. It causes no symptoms, has no bad results, and needs no treatment. The cause is unknown.

Ulcer of Frenum.—This is a small ulcer on the frenum caused by pressure and rubbing on the front teeth, usually by frequent, hard coughing. It is most often seen in whooping-cough. It heals readily if the teeth are covered and the ulcer touched with silver nitrate.

CATARRHAL STOMATITIS.

Definition.—This is a simple catarrhal inflammation of the mucous membrane of the mouth, unaccompanied by ulceration.

Etiology.—Irritants taken into the mouth, such as hot fluids or caustic fluids, dirty teething-rings or sugar-teats, or things the child may pick up from the floor, are active causes. It may be started by too frequently or too roughly cleansing the mouth. It often complicates the infectious diseases—measles, scarlet fever, diphtheria, or influenza. The eruption of the teeth may at times produce it.

Pathology.—There is congestion, accompanied by desquamation of the buccal epithelium. This is followed by increased secretion from the mucous and salivary glands.

Symptoms.—The mucous membrane of the mouth is red and, in places, swollen; it is at first dry and angry-looking, later bathed in a profuse secretion. The temperature is slightly elevated, the child is restless and fretful. The mouth is tender, as is shown by disinclination to eat, and evidences of pain when anything is put into it for nourishment or for examination. In severe cases the child refuses food altogether. The tongue is coated on the surface and reddened at the edges. Particularly marked redness may occur at the margins of the gums. The neighboring lymphatic glands may be enlarged and tender.

Prognosis.—This is good. The duration depends on the cause.

Treatment.—Discover and remove any possible cause of irritation. Attend to the general hygiene and diet. In prolonged fevers or any of the infections keep the mouth clean to prevent its occurrence. Use frequent, gentle applications of boric acid solution. In some cases a daily application of 5 per cent. silver nitrate will be useful.

FOLLICULAR STOMATITIS.

This is also called aphthous and herpetic stomatitis, because of the formation of small, yellowish-white spots which later develop into small ulcers. These ulcers are always superficial but may increase considerably in size.

Etiology.—There seems to be a reflex nervous origin of this form of stomatitis, similar to that seen in connection with herpes of other parts of the body. It seldom occurs in the first year, but later is frequently seen. The cause is general rather than local, and gastro-intestinal disorders and teething seem to predispose to it.

Pathology.—The initial pearl-colored vesicle is rarely seen but it is probably the original lesion; this is followed by a small, yellowish-white ulcer, first about the size of a pin-head, later spreading and sometimes coalescing to form a large patch. More or less catarrhal stomatitis is always associated, particularly in the area around the ulcer.

Symptoms.—There are a few or a great many ulcers, most frequently at the edge of the tongue, and the inner surface of the cheeks and lips; they may be scattered over the entire mucous membrane of the mouth and pharynx. By coalescing they may form large patches. The membrane is reddened in spots or over the entire surface, the tongue coated and the secretion markedly increased. The lymphatic glands of the neck are often swollen. There is marked tenderness, these children usually refusing food altogether. There are evidences of illness, the child being feverish, fretful and restless, usually more so than in the catarrhal variety.

Prognosis.—This is good, most cases recovering in a few days if properly treated. In badly nourished children it may frequently recur until the general condition improves. If neglected, it may develop into ulcerative stomatitis.

Treatment.—Correct any errors in the diet and general care of the child. Rinse the mouth frequently and carefully with liquor antisepticus diluted one-half or two-thirds with water. In ordinary cases this will usually suffice. If necessary touch the ulcers with 10 per cent. silver nitrate. These measures practically always bring about a cure.

ULCERATIVE STOMATITIS.

Definition.—This form of stomatitis is seen only after the eruption of the teeth, and consists in an ulcerative process beginning at the junction of the teeth and gums. It may

remain localized, or may spread to any part of the mouth. It is accompanied by a peculiar fetor of the breath.

Etiology.—It may be produced by overuse of mercury, or by phosphorus, lead, or bismuth poisoning; all these are now rare causes. Carious teeth, scurvy, bad food, poor surroundings, and persistent uncleanliness of the mouth are the common causes. Recent investigations seem to show that it is caused by the same organism that causes gangrenous stomatitis, but in a much less virulent form (the bacillus of Vincent's angina, or ulcerative tonsillitis).

Pathology.—Ulceration begins usually at the edge of the gums, and most often the outer surface of the lower incisors; it may begin anywhere in the mouth. It spreads along the gums, usually only on one side, but may cover the entire gums, and even spread to the cheeks where it may form large ulcers. The mucous membrane is much inflamed, swollen, and sometimes of a deep, livid hue. The periosteum of the bone may be affected, or even necrosis of bone occur.

Symptoms.—The most noticeable signs are the profuse salivation and the fetid odor of the breath. The mouth and gums bleed easily. There is usually little fever, but the child is restless, fretful, and any attention given to the mouth evokes evidences of severe pain. The gums are seen to be swollen, spongy, livid, and they bleed at the slightest touch. The line of ulceration is seen about the teeth, or it may be elsewhere in the mouth; it is covered with a yellowish-gray membrane or deposit. In severe cases some of the teeth may be loosened, or even portions of the bone decayed. The lymphatic glands of the neck are swollen and tender but rarely suppurate. The tongue is swollen, usually thickly coated, and shows the indentations of the teeth along its edges.

Prognosis.—If left to itself, the disease steadily progresses, the ulceration extending farther and farther until a frightful condition of the mouth results. The danger of the development of the gangrenous form should never be forgotten. In all cases seen reasonably early the proper treatment brings about a cure within a few days; advanced cases usually recover, but there may be loss of teeth and necrosis of bone.

Treatment.—First remove the cause, being particularly on the lookout for scurvy. Keep the mouth scrupulously clean by frequent washings with diluted liquor antisepticus, or even plain water; hydrogen peroxide diluted with three parts of water is useful when used three times a day. A solution of 1 per cent. alum or 1 per cent. chlorate of potassium is useful in severe cases, particularly if there is much bleeding. Both of these are painful, praticularly the potash.

Chlorate of potassium, given internally, is practically a specific. It should be given in 2-grain doses, largely diluted, every one or two hours during the day, according to the age of the child.

If the ulcers do not heal under this treatment, there is probably some disease at the roots of the teeth or the bone and some of the teeth may need to be extracted. If obstinate, the ulcers may be treated every other day with the solid silver nitrate.

THRUSH.

Definition.—This is a fungous growth appearing as white flakes or patches on the mucous membrane of the mouth. It is due to infection by the Saccharomyces albicans.

Etiology.—The fungus is the only cause, but it never grows except on a previously unhealthy mucous membrane. It is particularly common in the first two or three months of life, but occurs in infants of any age who are enfeebled by protracted disease, or who are decidedly under par from any cause. It may be conveyed by means of nipples, or anything that is transferred to the child's mouth, hence may be epidemic in hospitals or foundling asylums.

Pathology.—The structure of the fungus may be seen by placing a piece of the membrane on a slide and allowing to stand a few minutes moistened with liquor potassæ. It is composed of long, fine threads (the mycelium) and many oval bodies (the spores). The fungus lodges in some abrasion in the mucous membrane and spreads as a white, adherent patch. It may spread as many spots all over the mouth, or may coalesce and form large sheets. It may spread to the gullet. It never suppurates.

Symptoms.—The subjective symptoms are very slight, or absent. The appearance of the mouth is characteristic; the edges of the tongue, the inside of the cheeks and lips, or less frequently any part of the mouth or throat, present small white spots like specks of milk. Or the entire membrane of the mouth and pharynx may be covered. The flakes or membrane are removed with difficulty and leave a bleeding surface. The mouth is generally dry and the tongue coated; there may be sufficient pain to make the child refuse food. Other symptoms depend on the general condition of the child.

Prognosis.—It is not in itself a serious disease, but so often appears in a weak, debilitated child that it is associated in the lay mind with serious disease. If properly treated, and in a child strong enough to recover from the original disease, thrush always gets well.

Treatment.—Thrush may practically always be prevented by proper, and not too forcible, cleanliness of the mouth, and care of nipples, bottles, etc. When it has developed, it is treated by means of a mild antiseptic mouth-wash. A 2 per cent. solution of borax in glycerin, or one-third liquor antisepticus in water are as good as any. It is particularly needful to apply all remedies very carefully, so a wash is rather better than other means of application. Of course attention must be paid to any underlying condition.

GANGRENOUS STOMATITIS.

Definition.—This disease is also called noma, and cancrum oris. It consists essentially of a gangrenous ulceration usually beginning in the mucous membrane of the gums or cheek, and destroying all the tissue it attacks. Rarely it affects the nose, ear, and genitals.

Etiology.—It is usually secondary to the acute infections, most often measles, scarlet fever, typhoid and pertussis, in that order. It may follow ulcerative stomatitis, less often catarrhal. Most of the children are under five years, in poor condition, and nearly always in institutions. The cause is rather definitely established as the same organism that causes

ulcerative stomatitis and ulcerative tonsillitis, but the virulence is greatly increased by the poor physical condition.

Pathology.—The membrane first presents a dense, brawny induration followed by a sloughing ulcer. Extending through to the skin, this induration gives rise to a livid, glazed appearance, becoming purple, then black, and later perforating the cheek. The sloughing process usually spreads steadily until death occurs. Rarely there is a line of demarcation formed, the process stops, and the area is filled in with granulation tissue, which later scars over. Because of thrombosis in the vessels, hemorrhage is rare. Considerable portions of the cheeks, nose, and bones may be invaded before death occurs.

Symptoms.—These are usually not severe in the first few days of the disease; later there develop evidences of severe sepsis with high fever, rapid, feeble pulse, marked prostration with stupor, and usually diarrhea. Septic pneumonia frequently supervenes.

Locally the first thing to attract attention is the foul odor of the breath, with discoloration and swelling of the gum or cheek. There is first seen a dark, greenish-black spot, surrounded by a red and swollen area; this progresses from day to day until the greater part of the face may be affected, making a terrible picture.

Prognosis.—This is almost invariably fatal within one or two weeks, unless the child is a vigorous one and treatment constant and intelligent. Three-fourths of them die in spite of care.

Treatment.—The general condition should be supported by every means of nourishment and stimulation.

Locally, the diseased area should be excised and then cauterized with the actual cautery, of course under general anesthesia. If discovered early, the use of concentrated nitric acid, after cocainizing, may be effective if carried out thoroughly. The action of the acid can be stopped at any time with sodium bicarbonate. Any milder measures are sure to fail. The mouth should be kept as clean as possible by means of irrigations with mild antiseptics.

It should be a matter of routine to keep the mouths of children scrupulously clean when they are afflicted with any long or wasting illness.

DIPHTHERITIC STOMATITIS.

This is simply an extension of a diphtheritic process elsewhere, usually on the tonsils. It always represents a tremendous involvement by the organism of diphtheria, and the cases are nearly always fatal. Membranes simulating it may be the result of a wide-spread and coalescing herpetic stomatitis, or the extreme irritation of some powerful chemical. They are readily differentiated from the diphtheritic form.

GONORRHEAL STOMATITIS.

This is a rare condition resulting from infection of the newborn by an infected mother. There are present small ulcers, usually on the tongue or soft palate. Diagnosis is only made by the discovery of the gonococcus. Ophthalmia may be present and assist the diagnosis.

It is not a serious condition, readily clearing up with cleanliness and the use of mild antiseptics.

SYPHILITIC STOMATITIS.

This is mentioned here because of the frequency of syphilitic lesions in the mouth and the frequency with which they are mistaken for other conditions. They will be considered further elsewhere.

The most frequent manifestations are fissures, mucous patches, and ulcers. The fissures are found most often at the angles of the lips (and at the entrance to the nostrils). Usually there are several of them, and in healing they give a characteristic appearance of radiation from the corners of the mouth, caused by the many small scars. The ulcers are usually rounded, clean, and surrounded by a red, areolar area, and may be anywhere in the mouth. Usually there are not more than two or three present, often only one. Mucous patches are the same as in any other part of the body in the acquired form, and have no distinctive appearance.

ADHESIA LINGUÆ.

(Tongue-tie.)

This condition is due to an abnormally short frenum, limiting the movement of the tongue to a greater or less extent. It may be so short as to interfere with sucking and may prevent distinct speech later on. It is not nearly so important as is commonly supposed.

Treatment.—Snip the frenum near its attachment to the tongue with a pair of scissors and then loosen it to the base of the tongue by means of the finger-nail.

RANULA.

Definition.—This is a cyst forming in the floor of the mouth on one side of the frenum of the tongue, due to the occlusion of one or more ducts of the sublingual gland. There may be a single cyst or several cavities. It is usually spindle-shaped and so small that it causes no trouble; it may be so large as to interfere with the uses of the mouth.

Symptoms.—The tumor is painless, covered with normal appearing membrane, and fluctuates, showing the presence of fluid. The fluid consists of a glairy mucus.

Treatment.—Snip off the top of the cyst wall, evacuate the fluid, and cauterize the interior of the sac with the silver nitrate stick or carbolic acid.

ALVEOLAR ABSCESS.

Definition.—This consists of an inflammation beginning about the root of a decayed tooth or between the root and the gum. Pus is formed between the tooth and gum and if it does not quickly open into the mouth it causes severe symptoms, high fever, great swelling, etc. It may affect the perisoteum or even cause necrosis of the bone. It is fairly common in children whose teeth and gums are neglected.

Symptoms.—There is severe pain and great swelling of the side of the face, sometimes of extreme degree; if the pus is retained there is usually a chill, high fever, and the evidences

of severe illness. If about the lower molar teeth, it may present a fluctuating tumor on the outside of the jaw; if about the upper molars it may perforate the antrum of Highmore.

Treatment.—It can be prevented by keeping the teeth and gums clean and removing decayed teeth or filling those that require it. When pus forms, its evacuation should be hastened by the use of hot applications outside and hot washes inside. Usually prompt evacuation takes place into the mouth. If the pus is retained and the pain continues and the swelling increases, the abscess should be lanced and the cavity packed open. It will sometimes be necessary to incise from the outside to secure proper evacuation and drainage, but this should be avoided if possible on account of causing external scars.

CARIOUS TEETH.

Definition.—This is the destruction by bacterial growth of the substance of the teeth, bringing a number of evils that could all be prevented by proper care.

Symptoms.—As to the teeth, the evidence is plain. Other signs are foul breath, gingivitis, stomatitis, alveolar abscess, toothache.

The digestion is quite likely to be affected and the general health impaired.

Treatment.—The extreme frequency of this condition makes it of very great importance. The one preventive is proper care of the teeth; proper diet is also of importance in limiting the tendency of the teeth to decay.

Despite the prevalent belief in the unimportance of the first teeth, it is of prime importance to have every tooth promptly treated by a dentist at the first evidence of decay; the teeth should be frequently examined for evidences of decay. The permanent teeth are dependant for their proper alignment and shape on the proper development of the milk teeth.

DIFFICULT TEETHING.

This is the occasion of so much controversy that some mention must be made of it. Although the majority of

children cut all the teeth without any disturbance whatever, it is an undoubted fact that a very considerable minority is made uncomfortable, and a few present severe symptoms that recur so regularly with the eruption of the various teeth that their cause can be nothing else. These are usually fretfulness, disturbed sleep, failure to gain in weight, constantly chewing the fingers, increased saliva. More severe symptoms are fever, extreme restlessness, acute indigestion with diarrhea. Rarely epileptiform convulsions occur with such regularity on the eruption of the various teeth, and not at any other time, that one is forced to consider the teething as the cause.

Any evidences of illness during the eruption of teeth should be examined into very carefully before the cause is laid to the teeth; there is no doubt that the condition is often blamed to the teeth because the actual cause is undiscovered.

Treatment.—In some cases it is advisable to lance the gums when they are very tense, swollen, and the teeth apparently ready to come through. This sometimes gives instant and complete relief. Application of some astringent to the gums sometimes helps, such as 5 per cent. silver nitrate or tincture of myrrh.

It is best to cut down the feeding; certainly the child should not be urged to eat if disinclined. Small doses of bromide and antipyrine may be used to insure rest at night.

DISEASES OF THE THROAT.

ACUTE PHARYNGITIS.

Definition.—This is a diffuse catarrhal inflammation of the walls of the pharynx, usually affecting also the membrane of the tonsils, uvula, and faucial pillars. It is either a simple, primary infection or occurs as a part of some constitutional infection, especially scarlet fever, influenza, measles or diphtheria.

Etiology. It is most commonly caused by exposure to cold, with a subsequent infection of the throat due to the lowered resistance. Certain children are extremely subject to this infection and develop it after any undue exposure. These children frequently show a rheumatic diathesis. The disease is mildly contagious. No specific organism is known.

Pathology. The pharyngeal wall is dry, reddened, and shining, and usually also the neighboring structures. At first there is lessened secretion, but soon the secretion becomes abundant, being first mucus and then muco-pus.

Symptoms.—The onset is sudden, with pain at the angles of the jaws and a dry, rough feeling in the throat. There is some fever and usually an irritating cough; with young children there may be marked constitutional symptoms and a rise of temperature to 103° or 104° F. On examination a diffuse redness is seen over the entire pharyngeal wall, generally also extending to the tonsils, uvula, and soft palate. Often the posterior surface of the palate is affected and the posterior nares. It should never be forgotten that such a throat is often the first sign of one of the severe infectious diseases.

Treatment. The bowels should be emptied by means of castor oil or fractional doses of calomel. Small doses of phenacetin, given every three hours (1½ grains at two years), will reduce the fever, lessen the pain, and make the child more comfortable in general.

Locally, pieces of ice will relieve both the pain and the thirst to some extent. Spraying the throat, either directly or through the nostrils, with some mild antiseptic solution (Dobell's or Seiler's) will give relief and perhaps hasten recovery.

CHRONIC PHARYNGITIS.

This is a rare condition in childhood, but is of importance because it is so frequently associated with early hereditary syphilis, and because of the enlargement of the uvula that sometimes occurs with it. The uvula may become so long as to cause tickling of the base of the tongue and a frequent, irritating cough. The same enlargement, much more ex-

treme, is very rarely due to acute catarrhal inflammation of the uvula alone.

Treatment.—In the luetic variety the treatment is of course that of the disease. When the uvula is so long as to be irritating, the redundant tip may be snipped off with scissors if local astringents are ineffective.

In the acute enlargement of the uvula multiple incisions may reduce the swelling; if not, the tip may be snipped off, care being taken not to cut off too much, or long-continued bleeding may result.

RETROPHARYNGEAL ABSCESS.

Definition.—This is a collection of pus in the tissues of the wall of the pharynx. There are two varieties, so different as to need entirely separate mention, *i. e.*, the simple abscess of infancy, and the tuberculous abscess of older children with tuberculosis of the cervical vertebræ.

Simple Abscess.—This is an inflammation of the lymphatic glands of the lateral pharyngeal wall with a localized formation of pus and a marked swelling due to the accompanying cellulitis. Occasionally the inflammation appears and subsides without the formation of pus.

Etiology.—The cause is probably always an infection of the lymphatics from a primary infection of the nose or pharynx. It occurs most often in the first year, and rarely in children over two years. It is most frequent in the winter and spring when infections of the nose and throat are most prevalent. It follows influenza more frequently than any of the other infections, rarely scarlet fever or measles. It is usually seen in delicate children, but may occur in the most robust.

Pathology.—There is first an inflammation of the gland, usually due to the staphylococcus, with the formation of pus; accompanying this is an infiltration of the connective tissue of considerable extent, causing marked swelling and edema of the throat; to this the severe symptoms are due.

Symptoms.—The three symptoms of greatest importance are position of the head, dysphagia, and dyspnea. The head is drawn back as far as it can be held, to relieve the pressure on

the larynx; the breathing is evidently labored, takes place through the mouth, and is so noisy as to be distressing. Swallowing is difficult or may be impossible. The condition often presents symptoms of the most alarming character. Usually the temperature is raised from 100° to 102° F. several days before there are any local symptoms other than the nasopharyngitis. The abscess forms usually in five or six days, but it may take two or three weeks.

Locally, there is a swelling in the throat to one side of the median line, and it is by this the diagnosis is made. It may be only moderate or may be so large as to cross the median line, and seriously impede respiration. Sometimes there is an external tumor at the angle of the jaw on the same side. Fluctuation can be made out in the tumor sooner or later.

Prognosis.—This is almost uniformly good. The abscess, if left to itself, usually ruptures in the course of a week or so, the pus being swallowed or expectorated. Rarely the pus may burrow in the tissues of the neck and reappear as an abscess at some deeper point. Death may occur from obstruction of respiration or rupture of the abscess into the larynx. If properly treated, rapid and complete recovery is the rule.

Treatment.—The formation of pus should be aided by the application of hot compresses to the neck. As soon as fluctuation can be made out incision should be made at the thinnest point of the abscess wall. As soon as this is done the child's head should be held well down to allow the escape of the pus through the mouth. Incision may be made with a knife, the point of which is well guarded, or with the pointed finger-nail; it is well to widen the opening with the spreading jaws of a pair of forceps. After-treatment is usually unnecessary.

Tuberculous Abscess.—This is a collection of fluid in the tissues of the posterior wall of the pharynx, being an extension of a tuberculous process of the cervical vertebræ. It is not nearly as common as the preceding variety, and occurs nearly always in children over three years of age.

Pathology.—There is a well-advanced carious process of the bone before such an abscess can form, and unmistakable evidences of it can be made out on examination of the spinal

column. The abscess itself produces no symptoms until it becomes large enough to be noticeable through discomfort due to its size. Then there will be seen a bulging mass in the midline of the posterior wall, without any signs of inflammation about it; fluctuation is readily obtained. It increases very slowly in size, perhaps for months, and often burrows its way under the fascia to distant points in the neck or thorax. Frequently there is external swelling of the neck, sometimes on one side, sometimes on both.

Treatment.—If left to themselves, these abscesses may rupture into the pharynx, externally in front of the sternomastoid muscle, or they may extend considerable distances down the spine. They contain as much as a half-pint of fibrinous material in a thin liquid which does not have the characteristics of true pus, and they are on this account called "cold abscesses." When the pus is evacuated, it is usually best done by opening from without at the anterior border of the sternomastoid; they often refill and still more often continue to discharge for long periods of time, and it is therefore better to have the drainage opening on the outside. Various injections of antiseptics have been used to hasten the healing of such sinuses, notably the bismuth paste introduced by Beck.

ADENOID VEGETATIONS.

Definition.—This is a permanent hypertrophy of the so-called third or pharyngeal tonsil, a mass of adenoid tissue located in the vault of the nasopharynx just below the basilar portion of the occipital bone.

Etiology.—There seems to be a predisposition in some children, and in some families, to overgrowth of this tissue. The tendency is congenital, but the disease itself is nearly always acquired. Delicate children are most frequently affected. Damp, changeable climates seem to predispose to it. They often become first noticeable after an attack of scarlet fever, diphtheria or measles, more rarely some other infection.

Pathology.—The growth is a simple hypertrophy of the natural tissue of the third tonsil. When of recent development, as in young children, the tissue is very soft and spongy;

FIG. 10.—Adenoid vegetations. Group of children, all with obstructive adenoids, taken from two rooms in a St. Louis public school. All are perfectly normal otherwise, but show degrees of stupidity, deafness, mouth-breathing, etc., due to the nasal obstruction.

later it becomes firmer and more fibrous. It is attached to the vault of the pharynx above and behind, and sometimes at the sides.

Symptoms.—These are mainly the accompanying naso-pharyngeal catarrh, which is nearly always present and resists all treatment; and the evidences of mechanical obstruction to the breathing. The catarrh is manifested by the persistent discharge, becoming a little better or worse with the changes in the weather but never getting well; there is great difficulty in blowing the nose and clearing it of the discharge. Attacks of otitis are frequent and recurrent.

The interference with proper breathing causes restless sleep with dreams, night-terrors, and sometimes somnambulism.

The obstructive symptoms are sometimes pathognomonic. Continual mouth-breathing, snoring during sleep, a nasal voice, and gradually developing deafness from closure of the Eustachian tubes. Persistant mouth-breathing produces a typical shape of the face—a pinched nose, the mouth held open with an apparent prominence of the upper jaw and deficiency of the lower jaw, giving an expression of stupidity often quite at variance with the child's intelligence. There is often an actual stupidity resulting from adenoids of long standing, but fortunately this usually disappears entirely when the cause is removed. A deformity of the chest is produced also, with bulging of the sternum and retraction of the sides, due, of course, to the difficulty of inspiration.

Aside from the obstructive symptoms, children with adenoids are subject to acute inflammation of the tissue, very similar to acute tonsillitis. There is sudden inflammatory swelling of the adenoid tissue and the other lymphoid tissue of the throat. There is some fever, sometimes 103° or 104° F., headache, complaint of sore throat, and increased obstruction to nose-breathing. The child may appear to be very ill. Usually such an attack lasts only two or three days, but the swelling of the tissue lasts much longer. Many children have had adenoids removed shortly after such an attack when the tissue was still enlarged from the acute inflammation and would subside sufficiently in a few days or weeks to make its removal unnecessary.

Prognosis.—The growth has a tendency to increase until it fills the vault of the pharynx and then remains stationary until about puberty; then spontaneous atrophy seems to occur, and the obstruction it causes is lessened by the increase in size of the nasopharynx. The deformities produced and some of the checks on development never entirely disappear, but remain as a permanent handicap through life. Children with obstructive adenoids are likely to have more severe attacks of the acute infections than other children, particularly diphtheria and scarlet fever.

Treatment.—The only adequate treatment is the operative removal of the entire growth. After complete removal recurrence is rare. The results of a successful operation are brilliant, often entirely changing the appearance, disposition and mentality of the child.

The operation is simple, the only instruments needed being a mouth gag and a Gottstein curet, or modification of it. It is best performed under ether or nitrous oxide anesthesia with the patient in the reclining posture. The head should be so held as to prevent the blood from running down the trachea. Bleeding should have entirely stopped before the child is left alone. The preferable time for the operation is in the spring; next best is the early fall. No after-treatment is necessary other than tonics if the general condition indicates them.

FOLLICULAR TONSILLITIS.

Definition.—This is the common form of acute inflammation of the tonsils. It begins as a discrete inflammation of the crypts of the tonsils, resulting in numerous spots or patches on the surface of the glands, and from this appearance it takes its name. Later the whole structure of the gland is inflamed.

Etiology.—There is an undoubted predisposition on the part of certain children, and certain families, to attacks of this disease. The close connection between follicular tonsillitis, acute rheumatic fever and chorea is so often noticed that their common origin has come to be an accepted fact; laboratory researches have as yet failed to show a common infecting organism. The exciting cause is often undue exposure,

"catching cold," or sometimes close contact with another person having the disease; its contagiousness is certainly very slight.

Pathology.—The infection begins in the mucous membrane at the bottom of a crypt.

The crypt is soon filled with a whitish plug of pus, fibrin and epithelium which projects from the surface of the tonsil. The separate crypts being filled in the same way give the spotted appearance to the whole tonsil. A membrane may be formed by the coalescence of two or more patches. The whole tonsil usually becomes enlarged and inflamed. After many attacks the tonsils may become permanently much enlarged, or more rarely become very small and remain almost hidden behind the pillars. Both tonsils are usually affected.

Symptoms.—The disease begins suddenly, with chilly sensations, or a decided chill, a rapid rise of temperature to 102° or 104° F., and marked general malaise with headache, backache, and pains in the limbs. The pain in the throat is severe and often appears after the other symptoms. It is most noticeable in swallowing. The severe symptoms last three or four days.

On inspection the tonsils at first appear red and moderately swollen, but often on the first day the typical spots can be seen. It is observed that the spots usually rub off readily when swabbed, a point of importance in differentiating from diphtheria. The exudate in tonsillitis never appears elsewhere than on the tonsils. In any case that is the least doubtful it is well to make a culture for diphtheria.

Prognosis.—This is good as to recovery, even without treatment. The danger of infections of the heart valves, as in rheumatism and chorea, should always be borne in mind, though it is much less common. Children with frequently recurring attacks should be especially watched for this complication.

Treatment.—The value of the salicylates might be expected from the relation the disease bears to rheumatism. As a matter of fact, there are cases where they seem to give excellent results, but they cannot be regarded as having the same value as in rheumatism. Very young children take the

salicylates badly, as they are so likely to upset the stomach. The patient's comfort is best obtained by the use of small, frequent doses of phenacetine or antipyrine.

Locally, the most effective solutions are 10 per cent. nitrate of silver used every day, or the following applied to the tonsils three or four times a day:

Tincture of ferric chloride	12.0
Phenol	0.5
Glycerin, q. s. ad	30.0

A gargle or spray of some mild antiseptic solution often makes the throat more comfortable.

MEMBRANOUS TONSILLITIS.

Definition. This is an inflammation of the surface of the tonsils with the production of a membrane, due usually to the streptococcus, rarely the staphylococcus, sometimes to both; occasionally the pneumococcus.

Etiology. It may be a primary infection, or be secondary to scarlet fever, less often to measles and other acute infections. Quite recently epidemics of it occurred in Chicago, Baltimore and elsewhere which increased our knowledge of it considerably. The infection was traced in each case to a certain milk supply in which the virulent streptococcus was found. These epidemics were remarkable for the severity of a great many of the cases and the high mortality. Sporadic cases are not so severe.

Pathology. In the primary form the tonsils alone are usually affected. In the mild cases a thin, often gelatinous membrane is formed which is not firmly adherent; in more severe cases the membrane is identical with that due to diphtheria and the deeper tissue of the tonsil is affected, with the membrane firmly adherent. There may be considerable swelling of the cellular tissues of the throat and of the neighboring lymph glands; the membrane may spread to the uvula and soft palate, the pharynx, larynx; in fact, spread to almost any extent. Laryngeal cases give exactly the picture of laryngeal diphtheria. It is impossible to differentiate the severe cases except by cultural growth and microscopic examination.

The secondary cases are usually more severe and show a greater tendency to spread. Not infrequently there is a general septicemia developing from the severe throat involvement.

Symptoms.—In the primary cases there is usually an abrupt onset with a chill, or chilly sensations, headache, sore throat and often vomiting; the temperature rises sharply to 102° or 103° F., making an onset much like that of scarlet fever. These symptoms continue unabated for three or four days and then rapidly subside in the great majority of cases. In severer cases the symptoms follow the spread of the infection and depend on its severity.

There is first a swelling and reddening of the tonsils, followed in a few hours by the appearance of yellow or brown spots; these by coalescence form patches of greater or less extent, sometimes covering the tonsils, uvula, palate and faucial pillars, and the entire pharynx.

The secondary cases follow the same general course except that they are more likely to be severe. In some cases the involvement is extreme, attended by prostration, stupor, feeble pulse, and all the evidences of systemic intoxication. Great destruction of tissue with subsequent sloughing of portions of the tonsils or other tissues. The lymph glands are always involved and often suppurate, forming large abscesses in the neck.

Diagnosis.—This should in every case be definitely proved by a culture to show the presence or absence of diphtheria. The ordinary clinical course differs from the ordinary diphtheria but there is no other way to be sure.

Prognosis.—In the primary cases this is usually good. When the disease invades the larynx the outlook is extremely bad, as we have laryngeal obstruction and severe intoxication to deal with at the same time, and very slight means to combat the disease.

The secondary cases present a very different prognosis. Not only are they more severe, but there is the original disease to lessen the powers of resistance. The usual mortality, when secondary to scarlet fever or measles, is about 20 per cent.

The onset of pneumonia, empyema, peritonitis, etc., is always to be feared.

Treatment.—In the mild primary cases no treatment is needed other than measures to assist the comfort of the child; antipyrine, phenacetine, simple gargles and washes. In the more severe cases stimulation and proper nourishment, with frequent irrigation of the throat with mild, cooling antiseptic solutions, are about the only means at our disposal. Intubation or tracheotomy is necessary in laryngeal stenosis, but the results of either are not such as to make us hopeful in their use.

In the secondary cases the one measure that gives greatest relief is irrigation of the throat with saline solution, or some weak antiseptic solution. This should be done two or three or more times a day, using a douche can or fountain syringe containing one or two pints. The throat may be irrigated directly or, in young children, by means of a catheter inserted through the nostril. The ice-bag applied to the neck is the next best item, particularly if the lymph glands are much affected. Other measures are those of stimulation and feeding.

VINCENT'S ANGINA.

Definition.—This is an infection with a specific organism first described by Vincent, and characterized by the presence of superficial ulcers on one or both tonsils. Considerable evidence goes to show that the same organism is responsible for the origin of ulcerative stomatitis and gangrenous stomatitis.

Symptoms.—These are usually slight, with practically no signs of illness other than the slight soreness of the throat. There is moderate redness and slight swelling of one or both tonsils, and one or more superficial ulcers covered with a dirty white or gray membrane. Usually the lymph glands at the angle of the jaw are swollen. The diagnosis is readily made by culture, and this should always be done to detect possible diphtheria. The organism grows well on Löffler's medium as a large, fusiform bacillus, associated with numerous spirilla, and the appearance under the microscope is characteristic.

Treatment.—It should be treated by applications of solid nitrate of silver, with the internal administration of chlorate of potash. Sometimes it is quite resistant to treatment, but it rarely causes severe symptoms.

PERITONSILLAR ABSCESS.

Synonyms.—This is commonly called quinsy and phlegmonous or suppurative tonsillitis.

Definition.—It consists in the development of pus in the tissue of the tonsil which later escapes into the peritonsillar tissue and points outside the tonsil at some point in the mouth or pharynx. The commonest point is through the upper, outer part of the anterior pillar of the fauces. It is always unilateral.

Symptoms.—The disease begins generally as a follicular tonsillitis, but the local symptoms very soon become more pronounced as the others subside. The pain in the throat is severe, shooting into the ear. Swallowing and moving the jaw for any purpose make the pain intense. After a few days the patient presents a quite characteristic appearance, with immovable jaw, slightly opened mouth, thick nasal voice, and mucus and saliva drooling from the lips.

Inspection in the early stages reveals little to account for the very sore throat. Within two or three days the tonsil and the tissues around it become much inflamed and swollen, pushing into the isthmus, pushing the uvula to one side, sometimes nearly closing the isthmus. On palpation a soft, fluctuating swelling is felt, most often just above the tonsil. Sometimes the swelling is so low that it will be several days before the point of fluctuation can be determined.

Prognosis.—Recovery is the rule, even when the abscess is allowed to go on to spontaneous rupture. Death may occur from rupture into the larynx. Loss of weight and strength is sometimes extreme.

Treatment.—The disease may possibly be aborted in the very early stages, if the diagnosis can then be made. The treatment then is by large doses of sodium salicylate or salol, combined with small doses of Dover's powder, after an initial

saline purge. There is, however, always doubt as to the diagnosis if the condition clears up by this means.

If we decide that the disease is going on to the formation of pus, the process may be hastened by the application of as great a degree of heat as the patient can stand, kept constantly applied. With older patients gargling or irrigating frequently with hot liquids is also beneficial. Both of these measures also afford some relief. As soon as the fluctuating point can be made out, it should be opened with a guarded bistoury; this point will nearly always be at the upper, outer portion of the anterior pillar. If the pus is well localized, relief will be immediate. After-treatment consists in washing out the throat and keeping the exit open for the pus to drain.

Removing bad tonsils sometimes prevents recurrence; but cases do occur even after removal of the tonsils.

CHRONIC TONSILLITIS.

Hypertrophy of the tonsils is a better name for this condition, as the essential lesion is a marked increase in the size of the glands.

Etiology.—Hypertrophy of the tonsils is very frequently associated with overgrowth of the adenoid tissue, due to the same predisposition to excessive growth of the lymphatic tissues. Several generations in the same family may show this tendency. Often the hypertrophy takes place slowly without any preceding inflammation, and may reach the stage where operation is indicated without the child ever having an attack of acute tonsillitis. But the condition of hypertrophy certainly predisposes to attacks of acute tonsillitis, as well as to diphtheria. It is an exceedingly common affection.

Symptoms.—Hypertrophy of the tonsils so frequently exists in connection with adenoids of the nasopharynx that the symptoms of the two are blended and therefore difficult to separate. The child is usually presented for treatment on account of frequent attacks of sore throat. Often the condition is discovered when the child is being examined for some other trouble. Restless sleep, night-terrors, deafness, mouth-breathing, with the stupidity, deformities of face and chest;

any or all of them may be manifested, as in the case of adenoid growths. Both tonsils are enlarged, sometimes touching each other in the middle of the fauces. Sometimes they are quite small and buried behind the pillars which they push forward. These are cases of true chronic tonsillitis without hypertrophy. Between these extremes all grades of enlargement exist.

Usually their surfaces are rough and irregular, with deep crypts, but they may be almost smooth, depending on whether or not there have been previous severe attacks of inflammation or not. In younger children they are generally soft, due to the overgrowth of gland tissue; in older children the increase in fibrous tissue makes them very firm. The lymph glands in the neck are apt to be enlarged if there have been many inflammatory attacks. Often the tonsils can be felt as decided lumps on the outside of the neck at the angles of the lower jaw.

The increase in size usually ceases at about puberty and the tonsils may shrink and cease to cause trouble by obstruction. The inflammatory attacks also often become less in number but the tendency remains indefinitely.

Treatment.—Astringent applications of any sort rarely do any good in this condition. The only satisfactory treatment is their complete removal. This should be done in every case of marked, permanent hypertrophy, if it is accompanied by evidences of distress, or if there are recurring attacks of tonsillitis. It should not be forgotten that the very large tonsils are a menace in diphtheria and scarlet fever.

Inasmuch as the hypertrophy frequently develops after the amputation operation, it is advisable to perform complete enucleation. This removes the capsule with the tonsil and later growth is impossible. The Sluder instrument facilitates complete removal, and results with this instrument are probably more uniform than with any other. The operation is best performed under ether or nitrous oxide anesthesia, even though it is a short and not very painful operation. The fright is less and the operation likely to be more thorough. Bleeding is usually free for a few minutes but is rarely enough to cause apprehension. If it continues too long, as rarely happens, digital compression may be necessary; or a large forceps may be applied, one blade inside and the other out-

side the cheek, and the bleeding be checked by pressure of two pads fitted to both ends of the blades. Following operation a white or gray membrane forms as the raw surface heals; this looks so much like the membrane of diphtheria that it may cause alarm.

CONGENITAL CYSTS AND FISTULÆ OF THE NECK.

These are due to failure of the branchial clefts to completely coalesce, or to the imperfect closure of the thyroglossal duct. If the defect remains completely open, the result is a fistula; if the ends are closed and the interior patent, the result is a cyst. The branchial fistula communicates with the pharynx and the commonest external site is just above and to the outer side of the sternoclavicular joint. The thyroglossal fistula extends from the base of the tongue to an external point a little below the larynx in the median line. In the case of cysts, of course, there are no openings but small, fluctuating tumors. They may become inflamed and present the appearance of abscesses. They rarely cause any symptoms other than the tumor formation. Treatment is entirely surgical. One should be very cautious about opening an abscess in this region if he has any doubt about the source of it; opening a branchial or thyroglossal cyst under a misapprehension as to its character is a decidedly disquieting experience.

CONGENITAL DEFECTS OF THE ESOPHAGUS.

These are often associated with fistula or cyst of the neck, but may exist alone. The esophagus may be absent, the pharynx being closed completely below. There may be portions of the esophagus represented only by fibrous cords, rendering access to the stomach impossible. There may be points of nearly complete stenosis with dilatation above, or pouches projecting out from the esophagus.

The symptoms vary from difficulty in swallowing, with regurgitation of food, to complete inability. The diagnosis is confirmed by failure to pass a catheter into the stomach. Narrowing of the tube is amenable to surgical relief; the grosser deformities are, of course, incompatible with life.

RETRO-ESOPHAGEAL ABSCESS.

Definition.—This condition, as its name implies, is a localized collection of pus between the esophagus and the front of the bodies of the lower cervical or upper dorsal vertebræ. It occupies the same relative position as the retropharyngeal abscess.

Etiology.—There are two varieties of this abscess, as there are of the pharyngeal abscess, but here the one due to antecedent tuberculosis of the vertebræ is much more common. Even it is a very rare condition.

Symptoms.—These are extremely obscure and a diagnosis is not only difficult but practically impossible. The main symptoms seem to be dependent on pressure on the trachea, or irritation of one or the other of the pneumogastric nerves, which lie next to the esophagus. Sudden attacks of severe dyspnea, or of inhibition of the heart's action, are the symptoms most often noted. There is usually no difficulty in swallowing.

Prognosis.—This is uniformly bad. Diagnosis is next to impossible and hence intelligent treatment is out of the question. If the abscess ruptures spontaneously into the esophagus, recovery may follow.

SWALLOWING FOREIGN BODIES.

Physicians are frequently called upon to attend children who are said to have swallowed a foreign body of some kind—coins, pins, buttons, tacks, jackstones, pieces of bone, etc. With young children it is often impossible to be sure of the facts, and it is always well to investigate carefully the history and the circumstances; for instance, if the object is a safety-pin, find if it was open or shut. As a rule these objects pass into the stomach and through the intestines, and are discharged from the rectum without causing any disturbance.

Sometimes they lodge in the pharynx, the esophagus or in the trachea, and may cause unpleasant or very alarming symptoms from their presence. These symptoms are pain, dysphagia, dyspnea, retching, or cough. There may be some slight bleeding, particularly if the object is a sharp one.

The pharynx should be carefully inspected and palpated with the finger, and if the body can be felt, it can often be removed by the careful use of forceps. A smooth object can often be dislodged by holding the child by the feet, upside down.

The symptoms will usually give a clue as to the location, constant cough usually indicating the presence in the trachea, difficulty in swallowing pointing to the esophagus. The *x*-rays will show the location very closely, and should be employed when possible.

The use of the esophagoscope or bronchoscope will locate the object exactly, and often permit of its removal. When these are not available, an external operation is usually preferable to any forcible internal manipulation.

If the foreign body has apparently passed into the stomach, do not give a purge or emetic; nothing is to be gained by this and trouble may be caused. If the child is old enough, give some bulky food, as bread or potatoes, to form a covering for the object during its passage through the intestines. The stools should be watched for its appearance, principally because of the relief afforded the parents by the certainty of its passage.

CHAPTER X.

DISEASES OF THE CIRCULATORY SYSTEM.

DISEASES OF THE HEART.

General Considerations.—The position of the heart is more transverse in children than in adults. Up to the fourth year the apex beat is normally found in the fourth interspace and extends about to the left nipple line or a little outside it. After four years it is often in the fifth space, but may be normally in the fourth up to the tenth year; laterally it approaches the nipple line as age advances and by the tenth year is well within that line. After the tenth year the position is usually the same as in the adult.

Because of the thinness of the chest wall the cardiac impulse is apt to be diffuse and observed over a considerable area; and the apex beat is often hard to determine. The heart sounds are heard very distinctly. The first sound is much the louder, particularly at the apex; the second sound is also sharp and distinct. During excitement, hard crying, or in recovery from serious illness, the pulse is frequently irregular, but this is of no special significance. In infants the heart action is so rapid that it is exceedingly difficult to interpret murmurs, or to tell with which sound they occur. Frequently there is a reduplication of the second sound, due to difference in time of the closure of the valves; this is of no significance. Extreme variations in the pulse rate are of frequent occurrence and of no moment.

In very young children heart murmurs are nearly always systolic. This is often hard to determine by auscultation. The sounds are best analyzed with a stethoscope, and the most satisfactory is some form of bell. Accidental or functional murmurs are extremely frequent, and but little stress

should be placed on a heart murmur unaccompanied by other evidences of cardiac disease.

The pulse-rate decreases with the age in about the following way, bearing in mind that it is only during sleep or perfect quiet that these averages are obtained:

Six to twelve months	115 to 105 per minute.
Two to six years	105 to 90 " "
Seven to ten years	90 to 80 " "
Eleven to fourteen years	85 to 75 " "

CONGENITAL HEART DISEASE.

All abnormalities found in the heart at birth are classified under this head. The condition is not a common one, and it very often passes unnoticed.

Etiology.—This remains very obscure. Heart defects are often noticed in combination with some other faulty development, it having been noted often with Mongolian idiocy. It has been found that some cases give a positive Wassermann test, but the frequency of congenital lues makes it necessary to have greater observation on this point before deciding that it is a dominant factor. It is not believed that rheumatism plays any part in the production of congenital lesions. Some cases present evidences of undoubted inflammation, but what the factor in producing it is cannot be determined.

Pathology.—Any sort of malformation may exist, some of them being incompatible with life. There may be only a single auricle or a single ventricle. The commonest are defects in the interventricular septum, defects in the interauricular septum (patent foramen ovale), and stenosis of the pulmonary artery. Much less frequent are the patent ductus arteriosus, pulmonic insufficiency, and irregularity in origin of the great vessels. Defects in the left side of the heart are rare, whether of malformation or the result of fetal endocarditis. In only about 5 per cent. of the cases is there a single lesion, there being two or more defects in the great majority.

The heart shows dilatation and hypertrophy, according to the severity of the lesion, exactly as in the acquired form.

The enlargement is much more often of the right heart than the left.

Symptoms.—Unless cyanosis exists there may be no symptoms to attract attention. It is the most characteristic symptom; the most important one is present in perhaps half the cases and in the great majority of serious ones. In most of the cases that show cyanosis it is present constantly, these babies being familiarly known as "blue babies;" in

FIG. 11.—Congenital heart disease. Showing the typical drum-stick fingers.

others it is noted only after struggling or hard crying, or coughing. It may be evident only in the finger-nails, the lips and ears, or the whole body may be a distinct blue and the mucous membrane of the mouth have a purplish hue. Dyspnea is often associated, or develops later. The cyanosis is due to the deficient oxygenation of the blood in the lungs, not to the admixture of blood from the two sides of the heart.

Clubbing of the fingers and toes is another evidence of the poor circulation. It is present only in the cases showing cyanosis, and is usually proportionate to the degree of cyanosis. The clubbing becomes more marked with age.

Murmurs are extremely variable and difficult to interpret. Nearly always there is a single murmur, heard during systole, and usually most pronounced at the base. It is generally harsh, grating, and often accompanied by a thrill. Rarely a cardiac defect exists without any murmur.

A diagnosis of pulmonic stenosis may be inferred when the above murmur is located close to the left of the sternum in the second or third interspace, accompanied by a thrill, and with cyanosis and "drum-stick" fingers. With it is nearly always associated a defect of the ventricular septum.

Definite diagnosis of the particular lesion is impossible in most of the cases. And there is no value in making such a diagnosis.

Edema of the feet, face, and hands; dropsy and fluid in the serous cavities; bleeding from the nose, stomach and lungs; and marked dyspnea; all may occur as complications as the condition progresses. The children are usually undersized and underdeveloped.

Prognosis.—When the symptoms are such as to make the condition manifest, the prognosis is bad. Most of the cases die before twenty years of age, and during their life they are in a state of more or less constant discomfort. They are usually delicate, bear badly any acute disease, and are particularly vulnerable to diseases of the respiratory tract.

There are undoubtedly cases of congenital defect that live a fairly normal life, of usual length, and die of some other condition. The diagnosis in these cases has usually rested on a definite heart murmur, otherwise unexplained, with some right-sided enlargement of the heart.

Treatment.—For the defects themselves there is obviously nothing to be done. Relief of special symptoms is indicated as they arise. Occasionally there are severe attacks of dyspnea, accompanied by severe pain, that can be relieved only by morphin.

FUNCTIONAL HEART MURMURS.

Definition.—By this term is meant any murmur associated with the sounds of the heart in the cardiac area, with no defect to explain it.

Etiology.—The condition is more of a curiosity than of practical importance. The murmurs have been divided into cardiac and cardiorespiratory, and probably this division is a reasonable one; but the similarity of the conditions in which they occur make a definite origin and interpretation of small value. A reasonable explanation of those that occur during acute illness or *anemia* is the loss of tone in the heart muscle by which a relaxation takes place; in this way the valve becomes partially inefficient and a slight, temporary regurgitation occurs. As the muscle recovers its tone the condition returns to normal and the murmur disappears.

These murmurs are often transient, sometimes only of a few days' duration, sometimes disappearing and recurring very irregularly. In one form or another they are extremely frequent in childhood. They occur most often in anemia, during the course of acute disease, during convalescence from severe illness, and they occur often without apparent reason of any sort.

Symptoms.—The murmur is usually soft, systolic, heard best over the base of the heart and along the great vessels of the neck; sometimes it is audible over any large artery. It varies from time to time. Sometimes it is heard only with the child in a certain position, or it may be brought out only by exercise; and it tends to disappear as the physical condition improves.

Diagnosis.—The diagnosis is principally important from the stand-point of excluding any organic disease of the heart or vessels.

Treatment.—The treatment is that of the general condition.

FUNCTIONAL HEART DISORDERS.

Definition.—By this is meant abnormal action of the heart without any apparent change in the valves or musculature.

Etiology. Such abnormalities in the action of the heart are rare in children, especially under eight years. A neurotic tendency is often manifest. Nervousness from too much excitement, too much work in school, and, particularly, frequent attacks of indigestion, are potent causes. The use of tea, coffee or tobacco is apt to result in cardiac neurosis. It may follow severe illness.

Symptoms.—These are either excessively rapid or very slow action, or attacks of palpitation in which the child is conscious of the rapidly beating and tumultuous heart. With severe cases of palpitation there may be dyspnea, weakness, dizziness, ringing in the ears, even slight cyanosis and prostration. Usually such an attack lasts only a few minutes; it may last several hours.

Diagnosis.—This requires careful and frequent examinations to differentiate from organic disease. The size of the heart is normal. There is rarely any murmur; if one is present, it is of the functional variety. In palpitation the heaving, tumultuous, rapidly beating heart must be compared with the condition after the attack, when the action will be found normal. With simple tachycardia and bradycardia there is rarely any difficulty. The general condition of the child as to digestion and nervous temperament must be considered. Usually the children complain more, and the parents are more alarmed, in these cases than in the ones of true organic disease.

Prognosis. This is very good. The attacks themselves are never fatal, and with improvement in the general condition the attacks become less frequent and disappear. If there is a permanent nervous instability, they may never be entirely overcome, but even then the tendency is toward improvement.

Treatment.—The cause should be carefully searched for and corrected as far as can be. Attention to the diet is of great importance. Tea, coffee and cocoa should be forbidden. The hours of exercise, sleep and study should be carefully regulated, and overexcitement be absolutely prevented.

During the attacks the most useful drugs are aromatic spirits of ammonia, valerian, and bromide. Often no treatment of the attack itself is needful other than quiet and relief of fear.

PERICARDITIS.

Definition.—This is an inflammation of the serous covering of the heart and the sac in which it is contained.

Etiology.—In infants and young children pericarditis rarely occurs. After the fifth year it becomes more frequent. It is almost invariably secondary to some other disease. In young children the cause is nearly always an extension of infection of the left lung or left pleura; in older children the commonest cause is rheumatism. Other causes are scarlet fever, tuberculosis, septicemia, and rarely some other infection. Mediastinal abscess of any sort may cause a pericarditis. Trauma rarely is the cause.

Pathology.—This differs decidedly according to the infecting organism. With pus-forming bacteria (most frequently the pneumococcus, less often the strepto- or staphylococcus) there is a thick exudate of fibrin and pus, either covering the surfaces or forming a thick fluid in the cavity. In the rheumatic cases there is either a thickening and roughening of the membrane with a fibrinous exudate (the dry, or plastic pericarditis), or an effusion of a straw-colored serofibrinous exudate (the pericarditis with effusion). With every case of severe pericarditis there is some injury to the muscle of the heart. This may be so severe as to be responsible for the symptoms of dilatation, etc.

The fluid may be entirely absorbed with recovery, leaving no trace. There is often a permanent thickening of the membrane with slight interference with function. In other cases considerable permanent damage is done by the formation of adhesions between the visceral and parietal layers, interfering very seriously with the action of the heart, causing hypertrophy and ultimate heart failure. These adhesions may be of any degree, sometimes completely obliterating the sac. Some permanent change occurs in the great majority of cases.

Tuberculous pericarditis has the same pathology as tuberculous lesions elsewhere.

Hemorrhagic pericarditis is extremely rare in children.

Symptoms.—In infants and very young children the symptoms are very obscure, and it may be impossible to observe any change other than an increase in the severity of the illness due to the preëxisting disease, which is usually pneumonia or pleuropneumonia. There is probably a friction murmur at some stage in every case, but it is very difficult to hear when the sounds of the other disease exist. More important are weakening of the heart action, feeble, distant heart sounds, and later the increase in cardiac dulness. When these signs occur as a complication of acute pneumonia of the left side, pericarditis should be thought of.

In older children the usual form is the rheumatic. A diagnosis is easier, but the actual condition is often extremely difficult to determine. Early in the disease there is always the friction rub. This is usually a double sound occurring with both sounds of the heart, generally at the base. Very soon the signs of enlargement of the heart appear. Preceding these signs there is usually rapid pulse, some pain or distress in the cardiac area, and tumultuous action of the heart. Fever is always present, but usually has existed before the involvement of the pericardium; there may be a decided rise at this time.

The diagnosis of effusion into the pericardium is inferred when the heart dulness increases very decidedly, with no palpable impulse and very distant heart sounds. The apex beat may be displaced upward and be very faint. With large effusion the heart dulness becomes pear-shaped, with the apex above. The dulness to the right of the sternum may obliterate the cardiohepatic angle.

With the development of effusion the friction sound disappears.

Diagnosis.—The greatest difficulty is to differentiate from acute dilatation of the heart. Very rapid extension of the dulness is in favor of dilatation. The rapid pulse, feeble impulse, distant sounds and signs of embarrassment of the heart are not to be relied upon. It is sometimes impossible to differentiate without the trocar. It is also impossible

to determine whether or not the effusion is a purulent one without the needle.

The use of the exploring needle is not to be lightly undertaken for obvious reasons. Aseptic precautions should be extreme. Puncture is best made in the fifth interspace directly to the left of the sternum, slightly outward and upward. A flow of pure blood will indicate puncture of the right ventricle; this is not fatal, nor even very dangerous. One should be reasonably sure of the diagnosis before resorting to puncture.

Prognosis.—Purulent pericarditis is nearly always fatal. As this is the form usually encountered in very young children, it follows that the prognosis is bad at an early age. Opening and draining the pericardium is a formidable procedure, but some cases have recovered by that means. The rheumatic form is exceedingly grave, not so much because of immediate results as because of the grave permanent damage to the heart muscle and the embarrassment of adhesions. The results are much more serious, and prove more rapidly fatal than in endocarditis, or any other rheumatic affection.

Treatment.—Absolute rest in bed should be insisted on from the first. An ice-bag over the heart is the most important local measure, having a thin layer of flannel next the skin. Counter-irritation by mustard sometimes relieves the pain, and is useful particularly when cold is not well borne. Probably opium is the most useful drug, as it quiets the patient, relieves the pain, and quiets the cough which is frequently present. Digitalis is to be used with caution, but does assist in cases with marked dilatation. Strychnine and caffeine are of apparent value, but not much confidence is to be placed in any stimulant. The salicylates should be used in the beginning of the rheumatic cases; after the first few days their value is doubtful. With such a large effusion as to embarrass the heart decidedly, tapping is indicated. If the effusion is purulent, the sac should be opened and drained. Small effusions nearly always absorb, unless they are purulent.

Prolonged rest in bed and very careful watching of the heart are necessary in every case, particularly when much dilatation has taken place.

CHRONIC PERICARDITIS.

This is a condition in which there are adhesions connecting the visceral and parietal pericardium, due to preceding rheumatic pericarditis, or to tuberculosis.

Symptoms.—These are due to interference with the action of the heart. This shows itself in the enlargement of the heart, due to the necessity for undue work. Later developments are those of a weak heart, and cannot be differentiated from the same condition due to valvular disease or any other cause of heart failure. The only characteristic sign is the retraction of the chest in the neighborhood of the apex during systole; this is due to the formation of adhesions on the outer layer of the pericardium and is not of very frequent occurrence.

Prognosis.—In any case where the symptoms are marked the outlook is very bad. In the milder forms there may be no great disability, but when this is the case, the diagnosis is usually not made during life. The condition is often found postmortem when it was not suspected.

There is no treatment that has any effect.

ACUTE ENDOCARDITIS.

Definition.—Endocarditis is an inflammation of the lining membrane of the interior of the heart, most pronounced on the valves.

Etiology.—This may occur even in fetal life. The cause then is questionable. In early childhood the disease is rare, but after four years it becomes more frequent, and is most frequent from six to twelve years. The great majority of cases are due to rheumatism, chorea, or tonsillitis, even though the child had never had any marked joint or throat manifestations. Close questioning will elicit a history of rheumatism, chorea or tonsillitis in most cases, even though the rheumatic symptoms were only vague, indefinite pains. The number of cases due to other infections is small, and they are then usually of the ulcerative variety, which is separately considered.

Pathology.—The essential lesion is the formation on the valve leaflets of small "vegetations," due to the invasion of the bacteria. There is a small area of necrosis with slight bleeding; this becomes infiltrated with connective-tissue cells and forms a tiny lump on the surface. As this is organized it hardens and causes a shrinking of the valve tissue; many such organized vegetations will produce a thickening and crumpling of the valve, so that it no longer closes the aperture. This results in a leaking valve. New vegetations may be broken off and carried as emboli by the blood stream. In some cases the condition may clear up entirely, leaving the tissues in normal condition. The mitral valve is affected in the great majority of cases.

Some degree of myocarditis, with dilatation of the heart, is present in all but the mildest cases of endocarditis. In the severe cases this may be extreme, and the heart muscle shows the characteristic changes of that affection. Often there is also some degree of pericarditis.

Symptoms.—Most cases occur during the course of an attack of acute rheumatic fever or chorea. Then a careful observer will notice a decided increase in the pulse-rate, a further rise in temperature, and with this a soft, blowing murmur, systolic in time, and best heard, generally only heard, at or near the apex. With it there is some enlargement of the heart, even in cases of moderate severity. The action of the heart is tumultuous, and the apical impulse diffuse. Cases with marked involvement have very rapid pulse, dyspnea, restlessness, high fever, perhaps delirium; and the heart shows evidence of severe injury. The former are the most frequently seen, and they will be missed in the great majority of cases if they are not specially looked for, again and again, in every case of rheumatism, etc. The degree of severity of the rheumatism bears no relation to the severity of the endocarditis, as the most serious heart lesions may occur with mild attacks of rheumatic fever; indeed, they sometimes occur without any symptoms of other illness.

When the endocarditis is primary, it usually begins with a sharp rise in temperature, rapid, tumultuous heart, restless-

ness, rapid breathing and some prostration; the signs of heart involvement are the same as above.

The condition in its acute form lasts from two to four weeks. Then there is complete recovery, or such damage to the valves has resulted that chronic heart disease is the result. Death from acute attacks is rare in this country.

Diagnosis.—This depends on the physical signs rather than on the symptoms. Unless the heart is carefully examined in every illness, and every day during attacks of rheumatism, chorea, or fever of obscure origin, a great many cases of endocarditis will be missed. The combination of a persistent murmur suddenly appearing, heart slightly enlarged and heaving, rapid pulse, and slight restlessness, should be enough to make a diagnosis. If the murmur and enlargement persist, the diagnosis is certain.

Prognosis.—This is always serious. There are undoubtedly mild cases in which complete recovery takes place. Most always there is some permanent injury. If there is a leak in the valve segments, the condition of chronic heart disease results. The outlook then depends entirely on the amount of extra work the heart is forced to do. Life is usually shortened by every such leak. A great danger is the likelihood of recurring attacks of the acute disease which still further damage the valves.

Treatment.—The most important point is absolute rest in bed, to be insisted upon for a week after every trace of the acute symptoms has subsided. Great care against overexertion should be taken for several weeks more.

An ice-bag should be kept applied to the precordium as much as possible during the acute stage. Salicylates should be given in every acute case, in sufficient dosage. With considerable restlessness it is best to give bromide, or small doses of phenacetin. Opium may be necessary for this purpose, and it should not be withheld if needed. Heart stimulants are best dispensed with. The value of aconite in slowing the heart is doubtful. Little but the relief of symptoms can be expected from any drug.

Iron and the various tonics are often indicated after the acute stage has passed.

MALIGNANT (ULCERATIVE) ENDOCARDITIS.

Definition.—This consists in the destruction of portions of the endocardium by infection with some pus-producing organism. Its name denotes its severity, it being always fatal.

Etiology.—It is a very rare condition in childhood, and by no means common among adults. It is always secondary to some infection elsewhere, and follows as the result of invasion of the blood stream by the organism. This is most often the streptococcus, staphylococcus or pneumococcus; rarely the gonococcus, Bacillus pyocyaneous or influenza. In three-fourths of the cases there is a previous valvular disease of the heart.

Pathology.—On the part of the heart this consists in the formation of membranousous deposits on the valves, the existence of ulcers, or even the perforation of the valve. Inasmuch as the condition is a part of a general septicemia, the pathology necessarily involves the whole body. Often death occurs from general causes rather than from the heart involvement.

Symptoms.—These also differ very widely, being the result of the general infection. Very irregular fever, chills, sweating, prostration, delirium, almost any sort of combination of the febrile state may exist. There is often a fine, petechial skin eruption. Most frequently there develops a stuporous condition resembling typhoid fever. Death usually occurs in from two to three weeks.

On the part of the heart there is nearly always a soft murmur, usually at or near the apex, transmitted slightly to the left. There is overaction of the heart, weak sounds, and evidences of progressive enlargement.

Diagnosis.—This is generally very difficult, and made by exclusion of other diseases. The knowledge of preëxisting valvular disease is of great importance. The evidences of general sepsis, a state of delirium, a petechial rash, and the heart murmur with enlargement, are the points most likely to assist in diagnosis.

Treatment.- This is entirely directed to the relief of special symptoms. In the prolonged cases the use of autogenous vaccines has been employed. So far the results have not been successful.

CHRONIC VALVULAR DISEASE.

Definition.- This is the result of the healing of acute inflammation of the valves in acute endocarditis in which the distorted valve segments no longer properly perform their function.

Pathology.- By far the most common lesion is that of the mitral valve, and the injury is such that part of the blood is forced back into the left auricle as the ventricle contracts, the so-called mitral regurgitation. Much less often the valve is thickened and stiffened in such a manner that the opening is much too small and the flow of blood is impeded from the left auricle into the ventricle, the so-called mitral stenosis. In about 10 per cent. of the cases the aortic valve is seriously affected, and the result then is aortic regurgitation; stenosis of the aortic opening is excessively rare in children. In many cases two or more lesions are present, though usually there is only one that has given marked evidence during life.

Hypertrophy of the muscle and dilatation of the chambers of the heart are constant accompaniments. Mitral and aortic insufficiency show principally an enlargement of the left ventricle; mitral stenosis, principally an enlargement of the right ventricle and left auricle. These changes are often of extreme degree, the heart being perhaps twice its normal size.

Pathological changes elsewhere in the body are those of prolonged venous congestion, enlargement of the liver and spleen, ascites, congestion of the lungs, dropsy, etc.

Symptoms. *Mitral Insufficiency.*—This is the frequent lesion, making 90 per cent. of all cases in children. There is enlargement of the heart to the left and downward. The murmur is best heard at or just without the apex, is soft and blowing in character, occurs with or obliterates the first sound, and is transmitted to the left, often being easily heard

at the angle of the scapula. The second pulmonic sound is sharply accentuated.

Mitral Stenosis.—The enlargement of the right ventricle and the left auricle result in a transverse enlargement of the heart as a whole without much displacement to the left or downward; usually the dulness can be demonstrated to the right of the sternum. The typical murmur is short, harsh, presystolic in time, and sharply confined to an area inside and slightly above the apex. With it there is often a palpable thrill. Both murmur and thrill end in a loud, bumping first sound of the heart that is extremely characteristic of this lesion. The murmur is apt to be very irregular, sometimes being prolonged, beginning before and ending with the first sound and sometimes being diastolic in time. Mitral stenosis usually develops with prolonged, successive attacks of mild rheumatic pains, with slow and gradual heart involvement.

Aortic Insufficiency.—This is manifested by great enlargement of the left ventricle, and later of the entire heart. The murmur is diastolic, prolonged, usually taking the place of the second sound.

It is generally loudest in the aortic area or at the third intercostal space just to the left of the sternum, and extends down toward the apex. Characteristic of this lesion is the evident throbbing of the arteries in the neck, the sharp rise and fall of the pulse (the Corrigan or water-hammer pulse), the pistol-shot sound heard over the large arteries, and the capillary pulse, as seen by the alternate flushing and paling of the finger-nails, etc. The pulse can often be felt in the finger-tips.

The other valve lesions are so rare that they need no special mention.

During the stage of compensation, when the heart is acting well, there may be no symptoms of the disease, and it is discovered by accident in examination. Sooner or later certain evidences of cardiac insufficiency manifest themselves. Usually the first symptom is shortness of breath, after some comparatively slight exertion. The heart may be felt to beat too forcefully. Persistent cough may result from

congestion of the lungs, particularly in mitral stenosis. Later the visible signs appear; swelling of the feet, and dropsy elsewhere; severe cough with bloody expectoration; enlargement of liver and spleen; gastric and intestinal indigestion; dyspnea so severe that the child cannot sleep lying down; headache, vertigo and fainting attacks; all of these with feeble, irregular pulse, large overacting heart, and perhaps cyanosis.

Death may be due to sudden dilatation or failure, to intercurrent pneumonia, embolism, to any acute infection, and particularly to a recurrence of the acute endocarditis.

The condition usually lasts for a number of years, and children do not often die of the direct effects of chronic valvular disease. It is surprising how long one may live with a heart that seems almost to jump out of the chest. Often the chest wall bulges distinctly over the cardiac area, and the impulse be seen in the axillary line; yet the child may live for years in this condition. They are usually undersized, weak, tire very readily, and must be very carefully taken care of in every way.

Diagnosis.—This rests on a careful history of acute heart disease, rheumatism, chorea, or tonsillitis; a persistent murmur of rather typical nature; and some enlargement of the heart. With evidences of failing compensation there is never any question about the grave condition of the heart. A diagnosis of valvular disease cannot be made on a murmur alone. As a general rule it is a good plan to listen to the heart as the last step in the examination; too much importance then will not be placed on a murmur.

Prognosis.—On the whole this is not as good in children as in adults. At the time of puberty, especially, the extra strain put upon the heart is very considerable. Any acute illness increases the danger very decidedly, and probably leaves the heart less efficient. The danger from recurrences of the acute endocarditis is always present, and the difficulty of preventing overexertion in an active child is very great and its importance is paramount.

The commonest lesion, mitral regurgitation, is the most easily compensated. Many moderate cases live a long,

comfortable life. Mitral stenosis and aortic regurgitation are less readily compensated and usually develop symptoms of failure during adolescence, if not before.

Treatment. During the stage of compensation attention should be directed to conserving the heart's energy by a quiet life, free from excitement, running, hard playing, and with a period of rest during the day as well as long sleep at night. Moderate outdoor exercise, sleeping in the open air, regular eating of simple, nourishing food, and careful attention to the skin and bowels, are matters to be insisted upon. Medication, other than simple tonics when indicated, has no place during this stage. Particular care should be used to protect the child from all sorts of contagion. The heart should be carefully watched during any febrile illness to be assured whether or not there is a recurrence of infection in the endocardium.

When signs of failing compensation appear, absolute rest in bed is imperative. The venous congestion is relieved or prevented by saline purges and diuretics; caffeine is valuable here. The diet should be simple and nourishing, and as free from liquid as the child can comfortably stand. Prompt improvement should follow these simple measures, and perhaps no other measures are needed. Usually it is best to use heart stimulation. For this the best drug is digitalis. It should be used at first in full doses every three hours during the day and at night, if the child wakens. The tincture is the most reliable form, but the infusion is less apt to upset the stomach. A good sign of its effectiveness is the increase in urine, as well as the slowing and forcefulness of the heart. If there is already overaction of the heart, digitalis must be used with caution, combined with nitroglycerin, veratrum, or other motor depressant. Opium may be combined with it, or opium may be used alone if the action is very forceful. Trional or veronal may be needed to secure restful sleep; morphin may be the only drug that will induce this, and it should be used if necessary.

As the condition improves it is generally well to give iron in some form, cod-liver oil, or a stimulating tonic, of which strychnine is the best.

Tapping for the relief of dyspnea, extreme dropsy, etc., must be performed when nothing else gives the necessary relief. Not much is to be expected in the way of permanent relief, but decided relief in all the symptoms occasionally results and improvement then continues.

MYOCARDITIS.

Definition.—This is an inflammation of the muscular tissue of the heart wall.

Etiology.—As with the other heart affections the most common cause is rheumatism. It occurs not infrequently during other infectious diseases, most particularly diphtheria; less often in scarlet fever, influenza, and typhoid. It is probably a constant accompaniment of moderate and severe endocarditis and pericarditis.

Pathology.—There are two forms of myocarditis, but clinically they cannot be differentiated. Usually both forms occur in some degree in every severe case. The heart muscle is paler than normal, showing degeneration of the fibers, and the process is distributed throughout the walls; this is the parenchymatous inflammation. Here and there throughout the muscle are small areas infiltrated with round cells, sometimes so marked as to result in tiny abscesses; these are absorbed with the formation of points of scar tissue, and the process is called interstitial myocarditis. Any marked degree of myocarditis is always combined with more or less dilatation.

Symptoms.—The most typical sign is the weakening of the first sound of the heart. When marked, the two sounds are almost alike.

The intervals between the sounds are also nearly the same, giving the rhythm of the fetal heart. Sometimes, particularly after diphtheria, there is a splitting of the first sound, making three distinct sounds, the so-called "gallop rhythm." The heart is enlarged, sometimes very much so, and there may then be a systolic mitral murmur due to a relative insufficiency. Generally the pulse is fast, very soft, and the blood-pressure much below normal; very characteristic is the

occasional very slow pulse. The impulse of the heart is lessened and the apex beat difficult to find. In very severe cases the symptoms of failure of compensation are present, as in valvular disease.

The condition lasts a long time; even perfect recovery, when it takes place, is a matter of several months.

Treatment.—The condition so often exists without being suspected that it is wise to treat any patient with diphtheria, or other infection in which it may develop, as though myocarditis were imminent. Cases of diphtheria should be watched particularly closely. When the diagnosis has been made, complete rest must be insisted upon, and the necessity of prolonged care and watchfulness made known to the parents.

Treatment by drugs has little place. Severe myocarditis does not respond well to heart stimulants; in fact, strong stimulation is dangerous. Digitalis must be used with great caution, if at all. Full doses of strychnin seem to be of benefit, probably more from the general tonic effect than because of direct effect on the heart. Evidence of heart failure must be treated as in valvular disease, except for the feature of stimulation. The use of morphin combined with strychnin is of value in cases of sudden failure.

During convalescence, which lasts for many weeks or months, iron and general tonics are nearly always beneficial.

DISEASES OF ARTERIES AND VEINS.

ABNORMAL DEVELOPMENT.

Arterial hypoplasia is an uncommon, remarkable condition in which the aorta is only three-quarters or two-thirds its normal size; there may be a corresponding small calibre of the other larger arteries. It has been stated that this is of frequent occurrence in chlorosis, the chlorosis then being due to this congenital defect. Growth and development are retarded, and hypertrophy of the heart exists if the narrowing

is considerable. Anemia is often present, and occasionally an infantile condition of the genital organs. During life a positive diagnosis cannot be made. The condition is not incompatible with long life.

Nevus, also called Angioma.—This is a common disfigurement of childhood, due to congenital anomaly of the vessels.

There are two forms: the capillary, in which there is an increase in the number and size of the capillaries in a circumscribed area in the skin; and the cavernous, in which the blood circulates in large, irregular anastomising spaces without distinct vascular walls. The former are not much elevated, have a bluish or bluish-red color, and, when large, form an embarrassing disfigurement. They may be very small and slowly increase in size. The cavernous form is situated under the skin and forms a distinct tumor, soft and fluctuating. It disappears with prolonged pressure but at once reappears. Sometimes the color is not noticeable; sometimes they form large purple tumors, especially if under the mucous membrane, as of the lip, and pressure then has no effect. It is increased in volume by crying, coughing, or much exertion.

As a rule no other symptoms than the color or tumor are present. But large internal tumors may cause pain or displacement of organs in the neighborhood. Dangerous hemorrhage rarely occurs from them. Most often they are present about the head or neck, and are objectionable only from the disfigurement they cause.

Nevi rarely disappear spontaneously, and then only very small ones. They may increase slowly in size. The unsightly feature is the reason for seeking relief.

Treatment.—The treatment consists in one of several surgical measures, all of them having the object of replacing the tumor with scar tissue. This is so apt to result in disfiguring scars that it should be carefully undertaken.

CHRONIC ENDARTERITIS.

Inflammation of the arteries is exceedingly rare in children, as the essential item in the process is time.

Syphilis is much the commonest cause, but nephritis, tuberculosis, or other chronic disease may be the cause.

The change in the artery is the same as that in adults, plaques of thickening being present in the intima, and the wall of the artery being firmer than normal and more resistant. Very rarely aneurism is produced as a secondary result.

Diagnosis is impossible, but the condition may be suspected in a syphilitic child with hard pulse and perhaps high blood-pressure.

The general condition of such children is usually poor and the outlook for them is bad. There is no treatment of the arterial condition itself.

PHLEBITIS.

Inflammation of the walls of the veins is of importance principally because of the danger of embolism and thrombosis.

Injury to the vein itself, or the extension of inflammation from surrounding tissue, are the causes; it may occur during the progress of some acute infection, particularly typhoid fever. The commonest causes are infection of the lateral sinuses or jugular vein from infection of the mastoid cells. Simple phlebitis sometimes comes without apparent cause.

Pathology.—The vessel wall is somewhat thickened and red or grayish-red in color. There is more or less infiltration with leukocytes, and this may be apparent to the naked eye as minute yellowish spots. The blood is coagulated, forming a thrombus, and this may be suppurating; in old cases it may be partially or completely organized. The parts in the neighborhood may be reddened and swollen, but this is usually from inflammation extending outside the vein. A septic thrombus may be the cause of the phlebitis, and if this is the case it shows the effect of the suppurating process. In some cases of superficial phlebitis there may be no thrombosis at all.

Symptoms.—There are pain, tenderness, and a boggy feeling, perhaps edema, along the course of the vein; this is particularly likely in a superficial vein. When thrombosis

occurs, there are evidences of obstruction to the circulation below the clot; this is only noticeable if the vein is a large one. There is usually some fever and a mild feeling of illness before any local symptoms appear. If there is general sepsis, there are chills and sudden sharp rises of temperature, with other marked constitutional symptoms.

In cases due to a pus organism there may be abscesses formed in the course of the vein, or the whole affected part of the vein may be filled with pus.

The disease may last a couple of weeks, the inflammation subside, the thrombus absorb, and the condition then return to normal. Or it may run a chronic course, the thrombus and the walls of the vein become organized and be permanently obliterated; all signs of inflammation gradually disappear. Or pus may form and require incision. Portions of the thrombus may be broken off and be carried to other organs, producing abscesses if the process is a suppurative one.

Prognosis.—This is good, as a rule; and practically always is if there is no thrombosis. Septic phlebitis is dangerous because of the possibility of metastatic abscesses elsewhere.

Treatment.—Rest, and the avoidance of all unnecessary movement of the part containing the affected vein, are of primary importance. Any exertion increases the likelihood of causing parts of the thrombus to break off, thus producing an embolus. If the phlebitis is superficial, the use of cold or hot applications (whichever give the greater relief) may be tried. Belladonna ointment, or lead and opium wash, may be applied; their usefulness is doubtful. Morphin may be needed in the first few days for the relief of pain.

When a deep-seated vein is affected the treatment is purely symptomatic, with special care as to exertion of any sort. No drugs are of any value except to make the patient more comfortable.

The treatment of thrombosis is the same as that of phlebitis, as it usually is due to inflammation of the vein.

Embolism (the plugging of an artery by a solid particle carried in the blood stream) may need vastly different treatment, because it may affect such diverse parts. It is a

rare condition in children. It may occur from the breaking off of a small piece of a thrombus, from a vegetation loosened from a heart valve, fat getting into the circulation from a broken bone, etc. The commonest sites are the cerebral arteries, producing the signs of cerebral hemorrhage; lungs, causing dyspnea and perhaps pneumonia. The treatment, then, is that suited to the organ affected.

DISEASES OF THE BLOOD.

PECULIARITIES OF THE BLOOD IN INFANCY.

During the first week of life, and for a longer time in premature infants, the blood differs considerably from that of adults. Later in infancy the blood is much the same as in adults, except for a marked difference in the proportion of the different white cells.

In the newborn the specific gravity is high, the number of red cells usually considerably over 5,000,000, and there are a few nucleated red cells; these disappear after a few days, except in premature infants. Although the percentage of hemoglobin is high in the newborn, it is usually only about 80 throughout childhood.

The number of leukocytes per cubic millimeter is greater in children than in adults, and greatest in early infancy. In the newborn the average is about 20,000. They rapidly decrease, and at the end of the first week average about 13,000. Up to the sixth year the average is about 10,000. These facts are of great importance in considering the possibility of leukocytosis in children.

Another important difference is the very large relative proportion of lymphocytes and the corresponding decrease in the polymorphonuclear leukocytes. In the blood of children the lymphocytes constitute nearly 60 per cent. of the white cells, and the polymorphonuclear cells only 35 to 45 per cent. In adult life these proportions are 70 to 75 per

cent. polymorphonuclear, and 25 to 30 per cent. lymphocytes. The other leukocytes, the large mononuclear cells, the eosinophiles, mast cells, and transitional forms, are about the same as in adult life.

Leukocytosis, which means an increase in the number of white cells decidedly above the normal, occurs with slight provocation in children. And the normal variation in infants is so great that leukocytosis may be doubtful unless the count is very high. In older children the count is of relatively greater value, though the same restriction applies to a less extent.

The highest counts are obtained in epidemic meningitis and in acute pneumonia, especially lobar; counts of 80,000 per cubic millimeter have been observed in both diseases. This leaves out of consideration the tremendous high count in the various leukemias.

Many acute febrile conditions display a leukocytosis. Particularly important from the stand-point of diagnosis are appendicitis, osteomyelitis, empyema, any sort of acute purulent inflammation, and pneumonia and epidemic meningitis. In these conditions, and in most others, the increase is almost entirely in the polymorphonuclear variety.

In pertussis there is a leukocytosis which is manifested as an increase in the lymphocytes.

The infections that show no leukocytosis are measles, typhoid fever, malaria, usually influenza, and uncomplicated tuberculosis. In many others the leukocytosis is of little diagnostic importance, as scarlet fever, diphtheria, acute rheumatism, and others.

Of some importance is the occasional marked increase in the eosinophile polymorphonuclear cells. This occurs often with intestinal worms, trichina infection, asthma, and certain skin diseases, especially acute pemphigus, scabies, dermatitis herpetiformis, in fact in any skin affection where there is a great deal of exudation. Normally these cells constitute from 2 to 4 per cent. of the leukocytes; pathologically, they may be as high as 30 per cent.

SIMPLE ANEMIA.

Definition.—This is an impoverishment of the blood in which there is a noticeable reduction in both hemoglobin and in the number of red cells. It is also commonly called secondary anemia, as it is a consequence of some previous or existing disease.

Etiology.—It is an exceedingly common condition in children, being produced by almost any severe illness, malnutrition or unhealthful mode of life. Syphilis, tuberculosis, rheumatism, malaria; intestinal worms, particularly the hook-worm; in babies feeding on poor breast milk or the proprietary foods for a long period of time; all these are common causes out of the many.

Pathology.—There is none other than the pallor of the tissues and the evidences of poor nutrition.

Symptoms.—These are the signs of malnutrition in general. The tissues are flabby, the skin and mucous membranes pale. The children are weak, languid, sleep poorly, fret, are apt to complain of slight indefinite pains, headaches, etc. They are subject to attacks of indigestion, shortness of breath on exertion, perhaps fainting attacks. The pulse is weak and apt to be irregular; hemic murmurs are very common.

Diagnosis.—The diagnosis is made definite by examination of the blood. The hemoglobin is from 40 to 60 per cent., the red cells from 3,000,000 to 4,000,000. In severe cases there is some distortion of the red cells; in infants there may be a few nucleated red cells.

A simple method of determining whether or not there is any marked anemia is to prick alternately the finger of a healthy person and that of the suspected child; comparing the two stains on a piece of white linen will demonstrate even a moderate anemia.

Prognosis.—This is good only if the underlying cause can be removed. The anemia itself is nearly always amenable to cure.

Treatment.—This naturally resolves itself into the correction of improper feeding or mode of life, or the eradication

of the disease causing the anemia. Iron in some form should always be given, and one of the best forms is Basham's mixture. When a general tonic is needed for a considerable period, nothing is better than the double citrate of iron and quinine dissolved in sherry wine; this can be given in doses of 1 grain three times a day to a child of three years, preferably before meals.

CHLOROSIS.

Definition.—This is a primary anemia that occurs nearly always in girls near the time of puberty. It takes its name from a peculiar greenish tint of the skin.

Etiology.—This is quite obscure. It occurs nearly always in girls from twelve to sixteen years of age. Its occurrence in girls who are working away from home has led to the belief in homesickness as a cause. Probably confining occupations, unsuitable food, etc., are the chief causes. Virchow has called attention to the existence of narrowing of the aorta in certain of these cases.

Pathology.—Very few postmortem observations have been made. The observations of Virchow have been in a measure confirmed; and there has been noted hypertrophy and dilatation of the heart and an undeveloped state of the genital organs.

Symptoms.—These are of the same nature as in simple anemia. An almost contant symptom is constipation. Amenorrhea is very frequent. The characteristic symptom is the greenish-yellow color of the skin instead of the ordinary pallor of anemia. Attacks of hysteria and neuralgia are common.

The *prognosis* is good and the *treatment* the same as in simple anemia.

SPLENIC ANEMIA.

Definition.—This condition was first described by Von Jaksch and called by him infantile pseudoleukemia. It is apparently peculiar to infants and is a state of marked anemia in which the spleen is greatly enlarged.

Etiology.—This is still much a matter of doubt. Most of the cases occur in infants from eight to fourteen months. There is usually a history of improper feeding. Both tuberculosis and syphilis have been frequently noted in connection with it.

Pathology.—The spleen is very large and shows simple hyperplasia, with considerable increase in the trabeculæ; occasionally there is thickening and roughening of the capsule. Sometimes the liver is considerably enlarged, but there is nothing characteristic about it. Other changes are those of simple anemia.

The blood shows marked changes. The red cells are very much diminished, usually less than 3,000,000, rarely as low as 1,500,000. They vary greatly in size and shape, and there are numerous nucleated red cells, chiefly normoblasts but some or many megaloblasts. The hemoglobin is greatly decreased, generally to 35 per cent., often lower. There is a leukocytosis very constantly, usually numbering about 25,000, with the lymphocytes and polynuclears about equal; there is often a moderate eosinophilia.

Symptoms.—These are the same as in simple anemia with the exception of the large, firm spleen. This may be so large as to reach to the crest of the ileum. The pallor is very marked.

Prognosis.—This is usually good, but the condition is one in which acute disease of any sort is not readily withstood.

Treatment.—The general treatment is the same as that in simple anemia. Arsenic seems to have a particularly favorable effect, and is best given combined with iron. Fowler's solution, in doses of from ½ to 1 drop three times a day, is the most convenient form.

PERNICIOUS ANEMIA.

Definition.—This is a primary disease of the blood which is always fatal.

Etiology.—It is a very rare disease, particularly rare in children, and practically never occurs in infancy. It has been observed in connection with syphilis, has followed

severe simple anemia, and has followed prolonged tape-worm infection of the intestines. Most cases have no known etiological factor.

Pathology.—There is fatty degeneration of the heart, kidneys, liver and vessels; most remarkable is the pigmentation of the liver cells with deposits of iron. The bone-marrow of the long bones is quite red instead of the usual yellow; this is especially noted in the femur. All the tissues show the severe anemia, and there are often minute hemorrhages in the various organs.

The blood shows changes which make the diagnosis. The hemoglobin is reduced to 20 or 30 per cent. The red cells are frequently only 1,000,000 or less. The cells are much misshapen, but they have a relatively high hemoglobin content and stain well. There are many nucleated red cells, both large and small. Myelocytes are rare. There is no leukocytosis, but the relative number is increased, often giving an apparent leukocytosis.

Symptoms.—These develop slowly and insidiously. There is progressive weakness, dyspnea on exertion, palpitation of the heart. The skin and mucous membranes grow pale, the muscles soft and flabby.

The anemic pallor becomes profound. Bleeding from the nose and under the skin may occur, swelling of the feet, sometimes paralysis of the legs or other evidences of loss of spinal function.

The disease is often marked by periods of remission and exacerbation. It lasts from a few months to a year, being more rapid than is usually the case in adults.

Prognosis.—This is distinctly bad. Cases reported as cured are of doubtful significance.

Treatment.—No treatment has apparently been of the slightest avail. Removal of the spleen has been followed by marked temporary improvement. In some cases it has been so great as to justify it. The intravenous injection of salvarsan also has produced striking results temporarily. In such a hopeless condition anything should be tried that seems likely to assist in any way. Transfusion of blood from a healthy person has not proved of value.

Rest, fresh air, a nutritious and readily digestible diet, and the attention to proper functioning of the bowels are important.

LEUKEMIA.

Definition.—This is a primary disease of the blood, characterized by a tremendous increase in the number of white cells. According to the particular cells which shows an increase, the cases are called lymphatic or splenomyelogenous leukemia.

Etiology.—It is a rare disease under any circumstances, but especially rare in children. Cases have been seen in infants. It is more frequent in boys. Heredity seems to play some part in its development. It is apparently brought out by certain illnesses, as malaria, syphilis, or severe simple anemia; probably the tendency existed before the other disease appeared.

Pathology.—The essential changes are in the blood, spleen, lymph glands and bone-marrow. The spleen is tremendously enlarged in the splenomyelogenous variety, sometimes reaching to the pubes. The liver is considerably enlarged as well. The enlargement is due to hyperplasia and to the masses of lymphoid tissue deposited in the organ. The appearance of the spleen on cut section is much like that of the bone-marrow. The bone-marrow shows lymphoid deposits very similar to those of the spleen.

The lymphatic form shows less marked enlargement of the spleen and liver, but some increase in size is always present. The characteristic thing is the great increase in the lymph glands of the groin, neck, axilla, etc. Other lesions are those of the profound anemia, and are much the same in both forms.

The blood shows the great increase in white cells. In the myeloid form all the varieties are increased, with the addition of 20 to 40 per cent. of myelocytes. The total number may be 500,000 to the cubic millimeter, sometimes 100,000, rarely 1,000,000. The mast cells are always much increased. The red cells may not be much decreased early in the disease, but very soon they lessen in number and finally register

only 2,000,000 or 1,000,000. The hemoglobin reduction is in keeping with the red cells.

The lymphatic form is much more rare than the preceding, and is usually more rapid in its course. The blood shows the same changes except that the leukocytes are seen to be almost exclusively lymphocytes, they being from 90 to 100 per cent. in most cases. Usually the large ones predominate, but the small ones may be greater in number or they may be about equal. Red cells and hemoglobin present the same features as in the other forms of severe anemia.

In both forms the blood appears pale, and spreads on the cover-glass in an irregular way that is characteristic. At first the color may not be that of a marked anemia, but it soon becomes pale and watery.

Symptoms.—These are the same as in any progressive anemia. The points for diagnosis are the very large spleen and liver in one case and the enlargement of the lymph glands in the other. Examination of the blood at once makes the diagnosis. There are no diseases in which the diagnosis is easier.

Prognosis.—This is distinctly bad. The splenomyelogenous form is rather more chronic than the other, many cases lasting one or two years. The lymphatic form is usually fatal in a few months.

Treatment.—Nothing can be done other than the ordinary measures in anemia. Arsenic and the *x*-rays seem to produce more temporary abatement of the condition than anything else. Recently a number of cases have been treated with benzol; some marked results are reported, but a permanent cure is very doubtful. The ultimate outcome is not influenced by treatment.

HEMOPHILIA.

Definition.—This is a condition in which profuse, perhaps uncontrollable hemorrhage results from the slightest wound; or the bleeding may take place spontaneously. Such a person is called a "bleeder."

Etiology. The tendency is hereditary. It is remarkable that, although the males are affected twelve times as frequently as the females, the diathesis is transmitted through the mother. The real cause of the disease is unknown. It is quite probable that some element is lacking that prevents coagulation of the blood, but what it is, is not known.

Pathology. —These children are in other respects perfectly normal. No change can be demonstrated in the blood or bloodvessels.

Symptoms. —There are none except the excessive bleeding. Usually the tendency does not manifest itself before the second year; it may not be noticeable until the fifth or sixth. The bleeding may be spontaneous. This is very much oftener from the nose than elsewhere. It may be from the mouth, stomach or intestines, lungs, or any mucous membrane. The slightest bruise may produce severe hemorrhage under the skin or in the muscles. The affected person may bleed to death from a slight wound. Usually the first bleeding spell is not fatal. They usually bleed to death during childhood, but some reach adult life. With females there seems to be no tendency to very severe bleeding from the uterus. In some cases the bleeding seems to be periodical and then is likely to be accompanied by sharp joint pains.

The only means of *diagnosis* is from the excessive bleeding.

Prognosis.—This is always grave. There are no means of telling which are the cases likely to bleed to death. Fully half of them do not reach adult life.

Treatment.—After the discovery that a child is a bleeder, the greatest care should be taken to prevent injury; but this is rather useless. When the bleeding occurs, some sort of pressure is the most effective way to control it. Usually a ligature cannot be applied. When the bleeding has stopped, care must be taken not to disturb the injured part. After very severe hemorrhage, transfusion produces striking results. The injection of blood withdrawn from another person should be tried; or the injection under the skin of two or more ounces of horse serum. The value of the use of calcium salts is exceedingly doubtful.

After bleeding has ceased for some time, iron and general tonics are indicated.

Minor operations of any sort should not be performed on such children if they can possibly be avoided; not even the extraction of teeth, or circumcision. Girls having the tendency should be advised not to marry.

PURPURA.

Definition.—This term is applied to certain conditions in which there occur hemorrhages under the skin, from the mucous membranes, and occasionally in the internal organs. The different varieties have been given distinctive names; they all seem to have some sort of relation to one another. Cases in which the condition is secondary to some other known disease are called secondary or symptomatic purpura; those primary cases in which the bleeding is limited to the skin are called purpura simplex; those in which there is bleeding from the membranes or viscera are called purpura hemorrhagica.

Etiology.—The condition is a common one in children. It often occurs late in the course of any severe disease; it is especially apt to occur a few days before death, and for this reason is to be viewed with alarm in cases of serious illness. It often occurs in ulcerative endocarditis. In cachexia, severe anemia and leukemia it is frequent. Certain drugs, quinine, chlorate of potash, and others will give rise to it if used for a long time. Some cases are undoubtedly from stasis, as they occur in the feet and legs during convalescence from severe illness. All the above are secondary or symptomatic purpura.

Primary purpura occurs without warning and is apparently dependent on no other disease. The etiology is obscure. Lately experiments have been done to prove the part played by the blood platelets. There is certainly some evidence that a great decrease in their number may be responsible for the bleeding. The severe cases with high fever, severe abdominal symptoms, etc., have most of the ear-marks of a

specific, acute infection, but as yet no organism has been isolated.

Pathology.—In the simple form there is none but the subcutaneous hemorrhages, which may occur in any portion of the body. They may be deep-seated. Sometimes urticaria or edema are associated. More often the bleeding is from the mucous membranes or is under the membrane; most often it is seen in the alimentary tract, but may be in the respiratory tract, kidney, adrenals, joints, or any of the serous cavities. Some of the severe cases have the joint lesions of rheumatism, but no organism has been isolated to prove that there is a rheumatic infection.

Aside from the possibility of marked decrease in the platelets, the blood shows no abnormality other than that due to anemia from the hemorrhage.

Symptoms.—Symptomatic purpura is, of course, only a symptom in itself, associated with some known condition.

In the simple (subcutaneous) form of primary purpura there is often slight indisposition for a day or two, moderate vomiting and diarrhea, with perhaps a little fever. The spots then appear, most often first on the legs, sometimes on the legs and all over the body; occasionally there are isolated groups in various localities. They are first bright red, soon become copper-colored, and then go through the colors of an ordinary bruise.

They do not pale nor disappear on pressure. New spots usually come out from day to day. A pigmentation is left for two or more weeks. Sometimes a very severe attack comes on after several days of a mild one.

In the severe (purpura hemorrhagica) form there is bleeding from the membranes as well as in the skin. The nose, mouth, throat, intestinal or urinary tract may show profuse bleeding. Spots of ecchymosis may be seen in the mouth, conjunctiva, etc. Sometimes it begins with severe abdominal pains, diarrhea, and sharp rise in temperature, simulating acute abdominal inflammation. With these there is sometimes pain and swelling of the joints in various parts of the body. The urine often contains albumin and casts, but not enough blood to color it; it may be bright red with blood. The stools

are often black with blood; less often the blood is still red. These attacks of sharp abdominal pain with purpura and bloody stools have been called Henoch's purpura. Such attacks may recur at intervals of a few days.

Some of the more severe cases develop marked constitutional symptoms, great prostration, low delirium, high fever, and die in a few days. The course in all the others runs from two to six weeks; those having a protracted course usually recover.

A very severe form (purpura fulminans) rarely occurs, and is almost always fatal. The symptoms are extremely acute, severe, and the purpura develops rapidly and is very extensive. There is usually a chill, high fever, vomiting, rapidly developing delirium, and a fatal termination in a few days. The urine always contains considerable albumin. The spleen is enlarged and quite soft.

Sloughing occasionally occurs in any of the forms and may be a fatal complication, especially if it affects a large surface.

The rheumatic form (purpura or peliosis rheumatica) shows the signs of acute rheumatism with a purpuric eruption. It is more common in adults than children. Such persons are subject also to urticaria and erythema nodosum. These cases are usually mild and recover without difficulty. It seems probable that these are true cases of acute rheumatism. The occurrence in them of heart lesions has not been noted. Often there is tonsillitis occurring with these attacks.

Diagnosis.—This is usually easy after the eruption has appeared. It is impossible until then, or until there is evidence of some spontaneous bleeding. In scurvy the gums, the painful limbs, the age and the history usually suffice; hemophilia presents no signs of illness. The possibility of some severe acute disease having a symptomatic purpura must be considered, especially malignant endocarditis.

Prognosis.—This depends entirely on the severity of the symptoms. Cases with high fever, much prostration, much albumin in the urine, and particularly with the development of cerebral symptoms are very apt to end fatally.

Treatment.—Cases of purpura simplex usually recover without treatment; the possibility of the severe form develop-

ing in a mild attack should be borne in mind. The more severe forms should have absolute rest, bland, nourishing diet, and great care not to have any rough handling or bruising; gangrene sometimes develops at the site of an injury. An antiscorbutic diet seems to have some result, but it is usually in the more moderate cases that would probably recover anyway. The value of injection of normal serum is doubtful, but it should be tried in the severe cases; its use is still in the experimental stage, but in the absence of any drugs that are of value it should be tried.

For the very severe and gangrenous cases nothing can be done except to treat the symptoms as they arise.

Iron and arsenic are the best drugs to give for the anemia during convalescence.

CHAPTER XI.

DISEASES OF THE RESPIRATORY SYSTEM.

DISEASES OF THE NOSE.

EPISTAXIS.

Definition.—This is bleeding from the nose.

Etiology.—It is of very common occurrence in children, particularly from bumps and falls. When it occurs spontaneously it may be from any one of a great variety of causes. Delicate children who are kept indoors a great deal are prone to it; boys are more often affected than girls. In girls it is especially apt to occur about the time of puberty. A sudden, sharp blow, picking the nostril, great excitement or exertion, are common causes. It may occur in severe cases of any of the acute fevers, but is most common in typhoid, nasal diphtheria, malaria, the severe blood diseases, hemophilia and scurvy; it frequently occurs in nephritis, and may be the symptom that directs attention to the kidneys.

Pathology.—The source of the bleeding may be most any point in the nasal fossa, but usually it is the anterior chamber, and from a vessel of the septum. Often there is a small ulcer of the septum.

Symptoms.—Usually the bleeding is from one nostril, from which it drips slowly. In the great majority of cases the amount lost is small and no special attention is paid to it, as it ceases in a few minutes if let alone. If the point of bleeding is far back, the blood may be swallowed and the hemorrhage be unnoticed. Children who are subject to nosebleed often can tell when an attack is coming on by a sense of fulness in the head or a dull headache; this is relieved by the bleeding. Occasionally the bleeding may be so free as to cause faintness and dizziness.

Diagnosis.—This must be directed to find the cause of the bleeding, as the blood itself is manifest.

Prognosis.—This is serious only if it is caused by some serious organic trouble. Hemophilia and severe anemia and nephritis give it a serious aspect. It is often a bad sign in the late stage of severe infections.

Treatment.—A child prone to attacks of nosebleed should be made to live under the best hygienic conditions, be kept as much as possible in the fresh air, and by the use of daily cold baths be inured to sudden changes in temperature. If the epistaxis is due to rhinitis, adenoids, hemophilia, etc., appropriate measures should be taken for their relief.

During an attack the application of cold by a small piece of ice in the nostril may control it; in fact, ice in the mouth, or at the back of the neck, may cause reflex contraction of the vessel and so stop the bleeding. Astringents, as alum or tannin, applied to the membrane, may be effective. The most efficient styptic is epinephrin, alone or combined with 2 per cent. cocain. Plugging of the anterior nares may be necessary, but this is only effective if the bleeding is anterior. If it is posterior, the posterior nares can be plugged by passing a small catheter through the nostril, to which is attached a piece of silk; the silk is pulled through the mouth and a solid plug of cotton attached to it; by means of the thread in the nostril this plug is pulled into the posterior nares and effectually stops the bleeding.

When the bleeding has ceased, the child should lie quiet for some time, and should not blow the nose, which he usually does if not warned. If the bleeding spot can be seen, it may be touched with a silver nitrate stick to prevent recurrence of the bleeding.

ACUTE RHINITIS.

Definition.—This is commonly called "cold in the head," technically coryza. Coryza is the best name, for the process is as much an inflammation of the nasopharynx as of the nose itself; usually more.

Etiology.—It is an extremely common illness. It occurs most frequently in children who are coddled too much,

dressed too warmly, kept in overheated, poorly ventilated rooms, and never bathed in cool water. It is often brought on by exposure to draughts, sudden chilling of the body, and failure to quickly change wet shoes and clothing.

In all probability it is always an infection, the exposure, etc., simply making the membrane vulnerable to the bacteria. The most frequent infecting organisms are the staphylococcus or pneumococcus, and less often the Bacillus influenzæ and streptococcus. It is a constant early sign in measles and very frequent in influenza. Recurrent attacks are very often due to adenoid vegetations.

Sometimes this disease is undoubtedly contagious, even appearing in epidemics when whole communities are affected.

Pathology.— The nasal membrane is at first red, congested and swollen, and at first there is a very scant secretion, watery and irritating. Later there is a profuse mucous discharge, and the congestion and swelling lessen. When due to adenoids, these vegetations present the same acute congestion.

Symptoms.— In infants often the only evidence is the obstruction to nasal breathing, necessitating breathing through the mouth and causing difficulty in nursing. There is generally slight fever for a day or two, and restlessness and fretting. With older children there is a feeling of fulness in the nose and forehead, perhaps a slight headache; itching of the nostrils is common. Sneezing is nearly always present during this stage. The openings of the Eustachian tubes may be closed, causing deafness, ringing in the ears, or earache. Often the process extends to the eyes, causing a slight conjunctivitis; and it frequently extends to the larynx, causing hoarseness and painful cough.

The first day or two there is little or no discharge. Soon it becomes profuse, watery and irritating, and still later it becomes thick with mucus and muco-pus, which can be expelled in large quantities by blowing. Frequently the upper lip is excoriated from the discharge.

The attack lasts from four days to a week in the acute, uncomplicated cases. In the severe cases, usually in infants, there may be high fever, and great restlessness for a day or two: Often there is an extension of the infection to the

cervical glands, to the ear, larynx, or to the lungs, causing a bronchitis or even a bronchopneumonia.

Diagnosis.—This presents no difficulty. But it is necessary to bear always in mind the possibility of measles, influenza, diphtheria, and congenital syphilis. In the two former the constitutional symptoms, cough, conjunctivitis, fever, etc., should arouse suspicions; slight bleeding is apt to be associated with diphtheria, and a culture will show the presence of the diphtheria bacillus; syphilis is persistent and the condition does not clear up as it should; other evidences are always present, and the Wassermann test will probably clear up the diagnosis.

Prognosis.—In the simple cases this is good. Extension to the lungs is comparatively rare. Recurrences are apt to be frequent.

Treatment.—To correct the tendency to catching cold, susceptible children should be accustomed to sleeping in cool, well-ventilated rooms and to being out of doors every day.

They should be as warmly dressed as needed, but should not be bundled up too much. Every day they should take a cool-water sponge or plunge, having the water gradually made cooler until it is distinctly cold, this to be followed by a brisk rubbing. This tones up the vascular system and makes it more resistant to sudden temperature changes.

To treat the coryza itself the child should be kept indoors the first day or two in a room of constantly uniform temperature. The bowels should be emptied effectually at once, and the amount of food decidedly reduced and modified. The most effective combination of drugs is that of quinine, belladonna and camphor, given every hour. Tablets containing fluidextract belladonna $\frac{1}{12}$ minim, and $\frac{1}{8}$ grain each of quinine and camphor, may be given to a child of four years. Liquid albolene dropped freely in the nose often gives considerable relief, as does the cautious spraying of Dobell's or Seiler's solution. With little children a syringe with a soft, blunt point, or a Birmingham douche, is preferable to sprays or atomizers. If the congestion and obstruction are extreme, a dilute solution of epinephrin may be used; this will assist

nursing in the case of an infant. Some curative effect in the very acute cases follows the use of 20 per cent. argyrol solution, used in the nose two or three times a day.

CHRONIC RHINITIS.

Definition.— This is commonly called chronic nasal catarrh, and is a condition in which there is a more or less constant discharge from the nose for weeks and months.

Etiology.— The cause is nearly always something other than an inflammation of the membrane primarily. In the great majority of cases adenoids are the cause. Marked deviation of the septum, nasal polypi, syphilis and diphtheria, are frequent causes.

Symptoms.— On the part of the nose the evident symptom is the continual discharge from the nostrils. This frequently excoriates the upper lip, and large sores and scabs may result from it. Other symptoms are those of adenoids, etc., which have been elsewhere described. Examination of the interior of the nose may show abnormalities that need correction, or a foreign body that is causing it.

Diagnosis.— It should be remembered that chronic nasal discharge is a symptom and not a disease. A diagnosis is made only by discovering the primary cause. In particular should the nasopharynx be examined for adenoids, and the interior of the nose for polyps.

Prognosis.—This is good in general; but it depends entirely on finding the cause and correcting it.

Treatment. This, of course, differs as to the cause of the irritation. Adenoids must be removed, and the most striking results then follow. Polypi, foreign bodies, etc., offer an easy solution.

If no immediate cause can be determined the nostrils should be thoroughly cleansed twice a day by spraying or syringing with some mild alkaline solution. A satisfactory solution is one containing baking soda, salt and borax, a teaspoonful of each to a pint of water. Such solutions should always be used warm. After cleansing, it is advisable to use some mild

astringent, a few drops in each nostril; for this purpose 2 per cent. glycerole of tannin, or 1 per cent. sulphocarbolate of zinc answers as well as any.

HYPERTROPHIC RHINITIS.

Definition.—This is a chronic inflammation of the nasal mucous membrane, characterized by an overgrowth of the intranasal tissue, blocking up the nasal passages and interfering with respiration through the nose.

Etiology.—The commonest cause is some interference with nasal breathing through obstruction in the anterior nares, as deviated septum, or collapse of the alæ of the nose. This very greatly lessens the atmospheric pressure further back with a resulting chronic congestion. Living in low, damp localities, or continual breathing of dust-laden air, may produce it. The frequent attacks of acute rhinitis in these cases are believed to be a result of the chronic condition, not a cause of it.

Pathology.—The mucous membrane is thickened, both from hyperplasia and increase of connective tissue. The blood-spaces of the turbinate bodies are greatly engorged with blood and the connective tissue much increased; here also is considerable glandular hyperplasia.

Symptoms.—These are chiefly the result of interference with nasal respiration. This is usually most noticeable when the person lies, as then the obstruction is apt to be noticed first in one nostril and then in the other; the nostril of the side on which he lies is apt to be engorged and the other one comparatively free. The nasal obstruction gives a twanging tone to the voice described as "talking through the nose," but which is really due to the inability to contain the proper amount of air in the nasal chambers to impart resonance to the voice. The dryness of the pharynx causes irritability of the membrane and frequent attacks of pharyngitis. There is increased secretion of the nasal glands, but it is much more apt to accumulate and drop from the nose into the pharynx than to be discharged through the anterior nares. Expelling it by blowing the nose is difficult,

Diagnosis.—This should present no difficulty. The turbinate bodies are seen to be greatly swollen, often entirely occluding the passages. Nasal polyp is the only condition likely to be mistaken for it; this can be differentiated by the use of the probe and determining the presence or absence of movability.

Prognosis.—It is questionable if the inflammation can ever be completely cured. Much good can be done by hygiene and constant treatment. Some cases undoubtedly result in the atrophic form.

Treatment.—Special precaution should be taken to prevent these children from "taking cold"; plenty of fresh air, cold sponges, etc. A cleansing alkaline wash should be used night and morning. Cauterization of the membrane with chromic acid is the most effective means of reducing the swelling. Often it is necessary to remove portions of the turbinate bones; this can be done with a wire snare or with the actual cautery.

ATROPHIC RHINITIS.

Definition.—This is commonly called ozena or fetid catarrh, on account of the exceedingly foul odor associated with it. Atrophy of the membrane is the typical lesion.

Etiology.—It is a rather rare condition in children, but much attention is lately being paid to the probability of its being often a sequence of some childhood condition. Hypertrophic rhinitis, the purulent rhinitis of childhood, or suppurative inflammation of the nasal sinuses may be the cause.

Lately considerable work has been done to prove that a specific cocco bacillus is the cause of the disease, and reports of cures or great relief from the use of vaccines are reported.

Pathology.—The typical lesion is the complete atrophy of the mucous membrane, the epithelium changing from the normal columnar to the squamous. The glandular structures are destroyed. Crusts and scales form on the surface, and the putrefaction of these cause the foul odor.

Symptoms.—The nauseating odor which comes from the nasal cavities is the diagnostic feature. Sometimes this odor

permeates the whole room occupied by such a person, and he becomes an outcast because of it. A similar condition is only seen in cases of necrosis of the bones, as may be present in luetic rhinitis. There is very slight discharge, and the nasal passages are roomy and respiration free, except when the crusts form to such an extent as to obstruct it. There is frequently a marked dryness of the pharynx and larynx which gives considerable trouble; this is due to the lack of moisture in the inspired air which is not moistened in the nostrils.

Diagnosis.—This is made from the odor, the presence of crusts, the dryness of the cavities and the pharynx; and assurance that there is no necrosis of the bone.

Prognosis.—The disease is probably never cured. The only hope apparently lies in the proof of a specific infection, and the efficacy of a vaccine prepared from it. It is rarely possible to do much to relieve the symptoms. There is no danger to life.

Treatment.—Frequent cleansing and moistening of the cavities can be procured with the use of alkaline washes, or weak salt solution. The Birmingham douche is the best instrument to use. Some stimulating ointment with a decided aromatic odor should be used afterward; for this purpose menthol is as good as any. Crusts must be removed with cotton wrapped on a probe, and this should be done carefully. No application will cure the disease, but the crusts may be lessened, and the odor sometimes controlled, by using 0.25 per cent. iodine in potassium iodide and glycerin. The oil or ointment containing menthol and camphor, of each 5 grains to the ounce, is as good as any.

MEMBRANOUS RHINITIS.

Definition.—This is an infection of the nasal membrane with the diphtheria bacillus. Its importance as a source of infection to others makes it advisable to describe it with diseases of the nose.

Etiology.—This, of course, is the Klebs-Löffler bacillus.

Pathology.—The mucous membrane is reddened and swollen, and here and there are patches of grayish false membrane. There is often slight ulceration from which bleeding occurs.

Symptoms.—The main symptoms are the local ones, unless there is also an infection of the pharynx or larynx. Constitutional symptoms may be slight or wanting, as absorption of the toxin from the nasal membrane is slight.

The discharge is free, of serous or serosanguineous nature, and there is usually excoriation of the upper lip. This is of a chronic tendency and does not clear up with ordinary measures. Examination shows the membrane, in patches, or covering the entire interior of the nose as far as can be seen. If it does not spread to the pharynx, it usually subsides after two or three weeks.

Diagnosis.—This is definitely made only by the discovery of the diphtheria bacillus. Culture should be made to demonstrate this in every case of obscure, discharging rhinitis that runs a subacute course. This is particularly advisable if there is a blood-tinged discharge.

Prognosis.—This, of course, depends on the localization of the process; in the nose itself it is not dangerous to life in the majority of cases. Very often the cases are extremely intractable, even after the proper diagnosis and the use of antitoxin. Positive cultures may be obtained for weeks.

Treatment.—The patient should be isolated and the nose washed well with a warm solution of bichloride of mercury. This should be used by irrigation, a pint or more at a time, and the strength increased gradually from 1 to 15,000 up to 1 to 5000, if no signs of irritation result. Antitoxin should be given as a general rule, but its use depends on circumstances, as referred to under the heading of Diphtheria.

SYPHILITIC RHINITIS.

This is seen so frequently in infants who are the victims of inherited syphilis that it merits separate mention.

Etiology.—The disease is the result of syphilis contracted in intra-uterine life, and manifesting itself in the first three or four months after birth. It is also a tertiary lesion in adults, and occurs in late hereditary syphilis, but it is then a very different condition.

Pathology. –In the variety seen so frequently in young infants the lesions are those of a catarrhal rhinitis. Often there are superficial ulcers in the membrane, and more rarely there are mucous patches.

In late hereditary syphilis, as in adults, gummata are present in the deeper tissues, usually of the septum. These eventually ulcerate and cause necrosis of the membrane, cartilage and bone. The septum may be perforated, or the floor of the nasal cavity, a communication being formed between nose and mouth. The most hideous deformities may be the result; of these the most characteristic is the so-called "saddle-back" nose, in which the bridge is sunken so as to form a deep depression between the tip and the frontal bone. Nearly always there are ulcers of the hard and soft palate in these cases. Left to themselves without treatment these ulcers eventually heal by scarring and the deformities are permanent.

Symptoms.—In the infantile form the only symptom is the "snuffles" or evidence of catarrhal rhinitis which makes it difficult for the child to breathe, especially in nursing. This is productive of a peculiar snuffing sound from which it takes the name. The discharge is serous, usually with considerable mucus, and often tinged with blood. The lip is frequently excoriated. Always there are other evidences of syphilis elicited by careful examination. This condition nearly always manifests itself in the first few weeks after birth; rarely as late as the third month.

In the late hereditary form there is a tumor formation in the nose which at first causes considerable pain, swelling and reddening. At first there is no discharge, but as the gumma breaks down, there is copious discharge of mucus, pus, and blood. When the bone is involved, pieces of it may be picked out, and the probe will show the presence of necrotic bone. It is in this condition that the terribly foul discharge occurs, and which is properly called ozena.

Prognosis.—This is the same as of syphilis in general, and depends on the degree of involvement, the length of infection and the response to treatment.

Treatment.—Constitutional treatment for syphilis should at once be instituted. Local treatment consists in the use of a

cleansing spray; afterward irrigation with a 1 to 10,000 solution of bichloride of mercury, or insufflation of calomel, may be used daily.

NASAL POLYP.

Definition.—This is a localized hypertrophy of the mucous membrane, forming a pedunculated tumor in the nasal cavity.

Etiology.—It is a comparatively rare condition in children, and particularly so in infants. The cause is obscure, but many cases seem to depend on chronic inflammatory conditions of the nose, and particularly of the bone and the accessory sinuses.

Pathology.—The polyps are usually composed of a scanty connective-tissue framework, few bloodvessels, mucous and serous glands, and a large proportion of a myxomatous material; they are covered with epithelium. They are always more or less pedunculated, are rounded and of a bluish-gray color, glistening surface, and dent readily when pressed with a probe. They usually originate in the middle meatus.

Symptoms.—These are due to the accompanying rhinitis and to the mechanical obstruction to respiration. Itching and irritability of the membrane is frequent, causing attacks of sneezing. Asthma not infrequently is due to polyp. Usually the tumor can be seen and touched with a probe, best after shrinking the tissues with adrenalin and cocain.

Diagnosis.—With the history, and finding a movable, pedunculated tumor attached to the mucous membrane, the diagnosis is easy. Often a number of polypi are found.

Prognosis.—The prognosis is good, and a cure readily effected. The condition is apt to recur unless the underlying cause can be determined and removed.

Treatment.—This consists in the removal by surgical means. The cold-wire snare is passed over the tumor, and drawn tight around the pedicle, and the mass so removed. This procedure should be preceded by the thorough use of cocain. If there are several tumors, they had best be removed at separate times.

Following the removal of the polypi, simple measures usually clear up the accompanying catarrh.

HAY FEVER.

Definition.—This is a condition of intense irritability of the nasal mucous membrane which recurs with remarkable regularity in the affected persons at the same time every year. It is therefore called rose cold, autumnal catarrh, etc., according to whether it occurs during rose time, hay time, etc.

Etiology.—It is a rare condition except in older children. The agency of the pollen of certain flowers has been definitely shown to be the cause of the disease in many instances. Other cases are presumed to be due to a neurotic predisposition which manifests itself in extreme, periodic irritability of the nose and eyes. The great majority of cases begin in the fall months, with remarkable regularity, sometimes on the same day each year. Many people find they can escape the disease by going to a certain locality shortly before the time for the attack.

Pathology.—There are no lesions other than the intense redness and increased secretion of the mucous membrane of the nostrils, and generally of the conjunctiva.

Symptoms.—The disease begins suddenly, with a feeling of fulness in the head and slight malaise. Very soon the nose becomes obstructed so that it is impossible to breathe through it; sneezing begins and becomes almost incessant; the eyes are red, itching, watery, and light hurts them. The discharge is free, watery, and very irritating; the lip and nostrils may become very painful from the discharge and the frequent rubbing. Itching of the nostrils is sometimes almost intolerable. These symptoms continue throughout the attack.

In certain cases, in addition to the nose and eyes, the patients suffer from invasion of the bronchi. There may be considerable cough with scanty expectoration, and not rarely attacks of very severe asthma. The difficult breathing is constant, day and night, but apt to be much worse at night, and make sleep impossible. The attacks last for a month or six weeks, and usually disappear with the first frost.

Diagnosis.—This is usually made very accurately by the patient himself after the first attack. The picture is a typical one; the very red eyes, nostrils and lips red and sore, nose

and eyelids both swollen, and the evident photophobia and frequent sneezing, are usually sufficient.

Prognosis.—There is no danger to life, nor of any serious illness. But the very acme of discomfort, without real pain, is suffered by these patients without any possibility of substantial relief.

Treatment.—The use of drugs is extremely disappointing. Cocain will give temporary relief, but its use should be discouraged, as using it for any length of time is apt to result in habit formation. The same thing applies to the use of opium and morphin for temporary relief. The use of a very dilute solution of cocain combined with antipyrin, to shrink the tissues, and followed by the application of 1 to 5000 adrenalin solution will usually open the cavity fairly well. Then some bland oil spray can be used to soothe the irritated membrane.

The asthma is particularly difficult to control. Full doses of belladonna, combined with potassium iodide, are as useful as anything else.

Recently considerable work has been done toward preventing attacks in susceptible people by means of extracts of the pollen of various plants. It must first be known what pollen is causing the trouble; the use of the extract of the particular pollen in very minute and increasing doses has rendered certain persons immune and in others has much lessened the severity of the attacks. It is certainly a subject for further trial and investigation, in view of the hopelessness of any other treatment. If possible, a place should be found where the attacks do not occur, and the fall spent there.

DISEASES OF THE LARYNX.

ACUTE CATARRHAL LARYNGITIS.

Definition.—This is a simple catarrhal inflammation of the larynx of only a few days' duration, often accompanied by great difficulty in breathing and therefore often called catarrhal croup.

Etiology. There are two classes of cases, so different in their behavior that it is convenient to separate them. The mild form is seen chiefly in infants from six months to two or three years; the more severe form, with more decided inflammation, occurs in children from one to four years, and usually in the cold weather. The first form is frequently associated with large tonsils and adenoids, and certain children certainly have a decided predisposition to it, having attacks again and again. They are apt to have it with any slight illness. No specific organism has been connected with it.

Pathology.—In the mild variety there is a very slight catarrhal inflammation of the portion of the larynx above the cords, hardly sufficient to explain the severe symptoms except on the theory of reflex action through the irritability of the tissues. There is a spasm of the adductors of the larynx, producing the croup.

In the more severe form the membrane of the entire larynx is congested and swollen, with at first very little secretion. Later there may be infiltration of the deeper tissues with lymphocytes, and some edema of the submucous tissue. The change is usually most marked just below the laryngeal opening, and there may be true stenosis here. In older children there is rarely considerable edema of the glottis. The trachea, and often the bronchi, are affected in this form.

Symptoms.—The mild form is ushered in with a slight coryza or a mild hoarseness. The child does not feel sick; the rise in temperature is negligible. In the evening or at night a hoarse, metallic cough is noticed. This increases in severity and there is noticed some difficulty in breathing. The child may sleep comfortably through the night and the attack cause no more trouble. But in susceptible children decided croup manifests itself. The cough becomes very hoarse and the child wakens; in trying to cry it makes very little sound; and then comes the stridor of labored breathing. The child gets cyanotic, the chest sinks in inspiration, and the picture becomes alarming. This attack may last for a few minutes or two or three hours, when it subsides and the child at once is perfectly comfortable. Death very rarely occurs. Usually

such an attack occurs two or three successive nights, and no more. This is far the more common form of catarrhal croup.

The more severe form, or that in which there is a more decided inflammation, also begins usually as a coryza or with a slight cough. It is often a complication of measles, influenza or other acute infections. There may be nothing more to it than the cough, hoarseness, some pain and soreness over the larynx, and a tickling in the throat, a slight fever for two or three days, and the child is well.

But the symptoms may be quite severe from the outset, or become so in a day or two. Then there is a sharp rise of temperature, painful, hoarse, barking cough, and some difficulty in breathing. Inspection shows some retraction of the chest wall in inspiration and slight cyanosis. The child is prostrated, with rapid pulse, temperature of 103° or 104° F., and seems alarmingly ill. The condition is very apt to get better and worse at short intervals and there are times of very severe dyspnea. These symptoms keep up for two or three days and then gradually subside. Occasionally the inflammation extends down into the bronchi, and sometimes to the lungs, causing a bronchopneumonia. Rarely edema develops about the glottis and a fatal laryngeal spasm results.

Diagnosis.—The spasmodic form is distinguished by the absence of fever and constitutional symptoms, its short course, and often by the fact that the child has had similar attacks before.

The more severe form may easily be confounded with true diphtheria. The dyspnea is not so constant, and usually shows marked remissions. The fever is higher and the child complains more of pain. There is no glandular swelling, unless there is some infection such as scarlet fever. The presence or absence of a membrane can be determined only with a laryngoscope, and only in older children. In the catarrhal form there is no membrane in the pharynx, as there often is in the membranous form. Culture will show the true character. Where there is any doubt, the patient should be isolated.

Prognosis.—In simple catarrhal spasm the prognosis is uniformly good, unless the child is otherwise much enfeebled. Most of the severe cases recover, but one should bear in mind the possibility of fatal edema and spasm of the glottis. Also the danger of bronchopneumonia.

Treatment.—Any local cause for recurring attacks should be treated. If the child's general condition is poor, proper measures should be taken to correct that. Care should be taken that susceptible children are not unduly exposed to inclement weather, that they are properly dressed and properly fed.

At the outset of an attack the child should be kept in a room of a uniform temperature of about 75° F., in which the air is moistened by steam. The bowels should be emptied and the diet cut down. A very efficient means of moderating the attack is a hot mustard foot-bath, after which the child is warmly wrapped and put to bed. For the relief of the dyspnea nothing is more effective than giving syrup of ipecac by the teaspoonful until the child vomits, and then making a small tent (out of a sheet thrown over an open umbrella, if no other means is at hand) and conveying the steam from a kettle under it. Through the day, when an attack is anticipated, tablets containing $\frac{1}{100}$ grain each of ipecac and antimony may be given every two hours. Just before bedtime a full dose of antipyrin and bromide may be given. Hot cloths over the throat sometimes stop an attack.

In the severe cases the same measures may be effectual. The hot fomentations, with the use of continuous inhalations of steamed air, are the most effectual in the great majority of cases. Compound tincture of benzoin or turpentine may be added to the boiling water. But in certain cases the dyspnea can only be relieved by intubation. This should be performed when the breathing becomes more labored in spite of other measures for relief, when the child is growing steadily weaker, and particularly if the cyanosis continues for some time without lessening. The intubation relieves the symptoms at once, there is no further cause for anxiety, and the tube can usually be dispensed with in two or three days.

CHRONIC LARYNGITIS.

Chronic inflammations of the larynx are not infrequent in infants and children.

Etiology.—Most frequent is the simple catarrhal form seen with repeated attacks of sore throat, usually from the presence of adenoids, less often with chronic inflammation of the nose. It may occur from the second to the fifth year, less often later.

Tuberculous laryngitis is rare, and occurs most often in children much older. It is nearly always secondary to tuberculosis of the lungs.

Syphilitic laryngitis is not uncommon, being nearly always of the catarrhal form. Diagnosis is not possible except by finding evidences of lues elsewhere. Ulceration is extremely rare in children.

Pathology.—In the simple and the syphilitic cases there is simply a congestion of the mucous membrane, usually moderate in degree and extent. The tuberculous form always presents infiltration of the membrane and the formation of one or more small ulcers. The lungs, or the trachea and bronchi, are nearly always affected as well. The ulcers of the late form of hereditary syphilis are very rare.

Symptoms.—These are hoarseness, a dry cough, sometimes aphonia, and a thick, tenacious, but usually scanty, expectoration. In the tuberculous form the expectoration is often bloody, and the bacillus may be found in the sputum. Considerable ulceration may cause great pain, particularly in swallowing. In the simple form there is rarely pain, but there is often an uncomfortable tickling in the throat.

Diagnosis.—This is chiefly concerned with the particular variety, as the above symptoms readily establish the condition. The laryngoscope is necessary to determine the nature of the inflammation. If there is ulceration, the diagnosis lies between syphilis and tuberculosis. The luetic ulcers are much more apt to be in the anterior portion, as in the epiglottis, and there is often scarring and active ulceration at the same time. The tuberculous ulcer is most apt to be in the region of the arytenoids. Complete aphonia is rare in syphilis and common in tuberculosis.

Prognosis. The simple form can practically always be cured by removing the cause.

Treatment.—Local treatment is difficult and unnecessary. Treatment of the tuberculous form is directed toward keeping the patient comfortable and improving the general condition. Heroin or codeine, sufficient to lessen the cough, may give great relief. The ulcers should be kept clean by the use of warm alkaline spray and daily insufflation of iodoform; strong applications of nitrate of silver, 1 or 2 per cent., preceded by cocain, will often assist materially. The pain in swallowing may be so great that the larynx may have to be cocainized to allow the child to eat.

In the syphilitic form constitutional treatment must be instituted. Locally, strong solutions of silver nitrate assist the healing; iodoform insufflation is also valuable.

In all forms the voice should be used as little as possible.

EDEMA OF THE GLOTTIS.

Definition.—This is usually an acute inflammation of the larynx in which the submucous layer is invaded, resulting in marked swelling of the tissues. Much less often it is a simple edema of the aryteno-epiglottidean folds. Both forms are rare in children.

Etiology.—The rare, true edema occurs nearly always in the terminal stages of nephritis or heart disease. The inflammatory form occurs from intense irritation, as inhaling ammonia or other strong gas, severe catarrhal laryngitis, peritonsillar or retropharyngeal abscess, or deep infection of the neck as in erysipelas, rarely in scarlet fever. Rarely it occurs in angioneurotic edema.

Pathology.—The cellular submucous tissue is infiltrated with leukocytes and serous fluid, causing considerable swelling. This may be so great as to entirely obstruct the opening. The epiglottis may occlude the opening, and the interior membrane be much swollen.

Symptoms.—The characteristic, perhaps the only, symptom is intense inspiratory dyspnea, expiration usually being unimpeded. There is usually hoarseness, cough, considerable pain,

and swallowing may be difficult or impossible. The epiglottis may be seen to be greatly swollen. Symptoms of suffocation may develop at any time and death result in a very few hours. There is always the history of some intense irritant, some acute preceding disease, or the signs of inflammation elsewhere. Symptoms of true edema may be only the dyspnea, with the evidence of chronic nephritis, etc.

Prognosis.—This is extremely grave, as death often results before relief can be obtained. Even with prompt treatment death often results. It is always an exceedingly serious complication.

Treatment.—In inflammatory edema tracheotomy is the only certain measure of relief. Multiple puncture of the epiglottis may help, as may the application of ice about the neck, and swallowing bits of ice. Intubation is of no effect.

PAPILLOMA OF LARYNX.

Definition.—This is a small, glandular tumor of benign character growing from the mucous membrane of the larynx, most often on the vocal cords.

Etiology.—Nothing is definitely known as to the cause. They are not infrequent in childhood, and even in infancy. They show a tendency to recur after removal.

Pathology.—One or more small, warty growths may be present, most often on the vocal chords. They are nearly always sessile. There is no evidence of inflammation about them. The tissue is composed of irregular gland structure, considerable connective tissue, and often many leukocytes, showing a moderate chronic inflammation.

Symptoms.—Hoarseness is the prominent symptom, sometimes going on to complete aphonia. Often there is an extremely persistent cough. As the tumor enlarges, particularly if there is one on each cord, more or less dyspnea develops; this is apt to increase with a series of paroxysms.

Diagnosis.—This can only be made by seeing the tumor with the laryngoscope. This shows a granular, whitish or pink, sessile tumor, usually situated on the vocal cord; there is usually only one.

Prognosis.—This is not very good for complete, permanent cure, as they are so apt to recur. Operative treatment is apt to injure the cords, causing permanent hoarseness. Rarely they become malignant.

Treatment.—This should be undertaken only by one skilled in such work. In children the best results are obtained by tracheotomy and the insertion of a tube; the growth is let absolutely alone until the age of puberty, when the results from removal are very much better.

FOREIGN BODIES IN THE LARYNX.

This is usually due to the child laughing, crying, or coughing while holding some small object in the mouth. It is a common accident in childhood. If it is a sharp object, it usually lodges in the larynx; if smooth and round, it usually drops into a bronchus, most often the right; less often it stops in the trachea.

Symptoms.—These are sudden, violent coughing, with extreme dyspnea and cyanosis. This may dislodge the object and expel it.

If it enters the bronchus, there is usually sharp pain in the chest, hard coughing which is almost incessant, and often hemoptysis.

Diagnosis.—The history is of value; it may be necessary in order to get an idea what the trouble is. The laryngoscope or bronchoscope may locate the object.

Prognosis.—In many cases the hard cough expels the object. It may cause death by obstructing the glottis. Wherever it stops, it excites marked inflammation. If it remains in a secondary bronchus, it usually causes ulceration and the formation of an abscess, resulting in severe, prolonged illness, and eventually in death. Bronchopneumonia may result.

Treatment.—The first thing to be tried is holding the patient by the feet upside down; frequently the object is then expelled with the aid of the cough. The symptoms may be so extremely alarming that tracheotomy must be at once performed. If, then, the object is located in the larynx, it may be

removed through the tracheal wound, or an incision made through the thyroid cartilage. Exceptional skill is necessary to remove an object from the lower portion of the trachea or bronchi.

DISEASES OF THE BRONCHI, PLEURA AND LUNGS.

General Considerations.—In the infant the chest is much more nearly cylindrical than in the adult. The walls are thin and yielding, and the lung space is lessened by the height of the diaphragm, the large thymus, and the frequent distention of the stomach and intestines. The chest wall does not move so much during respiration, this being principally abdominal. The respiratory rate is materially increased by the most trivial causes, and is usually regular and quiet only during sleep or complete rest. The usual rate is as follows:

At birth	35 per minute.
At six months	30 " "
At one year	25 " "
At ten to twelve years	20 " "

The tissue of the lung is much more compact and the connective tissue more abundant. This, with the above differences, give a much sharper, more distinct quality to the breath sounds and much greater resonance in percussion. Great variation in all physical signs occurs normally from posture, struggling, crying, and often without any apparent cause, in perfectly well babies. Below the clavicles and between the scapulæ sounds are often obtained by auscultation and percussion which would be distinctly abnormal in an adult or a well-grown child; fremitus from a little mucus in the bronchi, cracked-pot sound, bronchial breathing, etc. Unless the child is perfectly quiet, the physical examination of the chest is apt to be very misleading.

These peculiarities lessen with age, and the child at ten years presents much the condition of the adult.

ACUTE BRONCHITIS.

This is a catarrhal inflammation of the mucous membrane lining the larger bronchi, less often both the larger and smaller.

Etiology.—It is an extremely common condition in both infants and older children. Certain children have a manifest predisposition to the disease, without any apparent reason. Others are very susceptible from the presence of large tonsils and adenoids, rickets, or any sort of malnutrition. It almost invariably accompanies measles, pertussis, and influenza; very often it complicates typhoid, diphtheria, scarlet fever, or any acute infection, particularly of the nose and pharynx. The primary form is most common in the late winter and early spring, when the weather is very changeable. It is usually due to exposure to cold, neglecting to quickly change wet clothing, etc.

The organisms are usually the pneumococcus or staphylococcus, less often the streptococcus.

Pathology.—In the simple acute bronchitis there is congestion of the membrane of the larger bronchi alone, always of both sides. In more severe cases the smaller tubes are affected; and in the severe form seen often in infants there is an invasion of the capillary bronchi. The latter is very difficult to differentiate from bronchopneumonia, and probably always has some infiltration associated with it.

The amount of secretion is always increased, often very profuse.

Symptoms.—The disease in the mild form has a gradual onset, usually following a coryza. There is slight fever, malaise, and short, dry cough. The respiratory rate is increased decidedly in infants, and they also show considerable fretting and restlessness. The cough increases in frequency, and in two or three days becomes looser and expectoration is easy; the symptoms persist for about a week, and recovery usually promptly follows.

In the more severe cases all the symptoms are intensified. The temperature may go to 103° or 104° F., the cough very frequent and painful, the respiration very rapid, there may even be slight cyanosis. The pulse is rapid and the child

perhaps considerably prostrated. In the early stages the secretion is scanty and the cough consequently painful; later expectoration is free, the cough becomes less painful, but the increase in sputum is not otherwise apparent because the young child invariably swallows the sputum as it is coughed up. Usually the appetite is impaired or lost. Vomiting is not uncommon following a coughing spell.

Not infrequently these attacks begin suddenly, and it is then impossible to tell for a time whether we have to do with bronchitis or bronchopneumonia. And pneumonia may at any time intervene. These cases usually last longer than a week, and recovery is more prolonged.

Physical Signs.—The respiration is visibly increased. At the time of examination there are usually many coarse dry rales heard equally well all over the chest. These soon give place to large mucous rales. There is usually a marked bronchial fremitus, felt by placing the hand over the chest. There are no other signs in the mild cases.

In the severe form there are small and large dry rales everywhere. The nostrils dilate in inspiration. There is often some retraction of the chest wall. Slight cyanosis is not uncommon. Prostration and dyspnea depend on the age of the child and the severity of the attack. Often the appearance is exactly that of an acute asthma. As it progresses the rales become moist and bubbling, expectoration is profuse, the cough easier, and the child soon becomes much more comfortable. Complete recovery may take from one to two weeks.

Diagnosis.—The principal difficulty is in excluding pneumonia in severe cases. For the first day or two this is often impossible. The symptoms may be much more severe than in a real pneumonia. The high temperature never lasts more than two or three days; and there is never any dulness, and the characteristic crepitus at the end of inspiration is not heard. In older children there is rarely any difficulty in the diagnosis.

Prognosis.—In infants, and particularly those in poor general condition, a severe attack is always cause for apprehension. The fine bronchi are so apt to be affected, and

pulmonary congestion or pneumonia develop, that the prognosis should be guarded.

Treatment.—The child should be kept in a room with an even temperature of about 75° F., and put on a light, easily digestible diet. The bowels should be opened freely, fractional doses of calomel being an effective means. Most cases will recover perfectly with no other treatment.

In more severe cases the child may be made more comfortable by the use of one-third turpentine and two-thirds camphorated oil rubbed well over the chest, and then covered with an oiled silk jacket. With considerable cough, pain and dyspnea the inhalation of steam, impregnated with creosote or turpentine, is very effective. A mustard pack will sometimes give relief when these measures fail. In most severe cases no other treatment is needed, and the less internal medication the better, particularly in infants. If indicated, the tablets of ipecac and antimony, of each $\frac{1}{10}$ grain, may be given every two hours; or 1 or 2 grains of ammonium chloride in solution. Later, when the secretion is more abundant, the elixir of terpin hydrate, 10 to 30 drops every three hours, is sometimes helpful.

In cases of sudden collapse, or feeble, superficial respiration, nothing acts so quickly and effectively as a hot mustard bath, one ounce of mustard to a gallon of water.

CHRONIC BRONCHITIS.

This is not nearly as common in children as in adults, and less common in young than in older children. It nearly always follows a series of attacks of the acute form, and generally in a child in poor physical condition. It is always present in chronic tuberculosis of the lungs, and often occurs in heart disease. It is quite apt to follow the acute bronchitis of measles or pertussis.

Pathology.—The bronchial mucous membrane is in a state of chronic congestion, with an excessive production of mucus.

Symptoms.—A persistent, troublesome cough, with the expectoration of a great deal of mucus, is often the only symptom. It is nearly always more troublesome at night and

early in the morning. The only physical signs are the presence of scattered rales, coarse and fine, dry and moist; and the slightly impaired general condition.

These children are always better in summer than in winter, and are subject to frequent attacks of acute bronchitis.

Prognosis.—This is usually good, as most of the children are cured by intelligent handling.

Treatment.—The general health should be attended to by appropriate measures. They should not be confined to the house except in inclement weather; fresh air and sunshine can hardly be overdone. Often a change to a more suitable, usually warmer, climate is good. A general tonic treatment is indicated, and prolonged use of cod-liver oil is very effective. Creosote and terebene are the most effective expectorants.

FIBRINOUS BRONCHITIS.

Definition.—This rather rare disease consists in the formation of false membrane on the walls of the bronchi.

Etiology.—Some cases are due to diphtheria, though it is a rare complication of diphtheria. Other cases are infections due to the streptococcus or staphylococcus usually. The condition is nearly always associated with some disease of the lungs, especially pneumonia.

Pathology.—The trachea and larger bronchi are usually involved, but often only portions of the bronchi, on one or the other side; sometimes it extends to the smallest bronchioles. The membrane may be adherent, or in places may lie loose in the tube; rarely complete casts of the larger tubes are loosened and discharged.

Symptoms.—These are quite similar to the symptoms of bronchitis, and may be acute or chronic. The dyspnea is more severe and the cough is apt to be very forceful.

In the chronic form there are only the cough and dyspnea.

In both sorts the diagnosis is made by the character of the sputum. This is in the form of balls or plugs firmly matted; placing in water reveals their character, as they lengthen into the characteristic tubes or shreds, according to whether they come from the large or small tubes.

Prognosis.—The acute cases run a course of from two to four weeks, and in the great majority of cases have a fatal outcome. Chronic cases are not fatal in themselves, but offer the danger of other acute infection of the lungs. Often they recover completely after several months. There may be recurrences of moderate attacks for one or two years.

Treatment.—In general this is the same as in the catarrhal form. Treatment of any sort has little effect. Most efficacious are the inhalations of various sorts. Emetics at intervals may assist in expelling the membrane. Inhalations of oxygen may be of assistance in extreme dyspnea. Of course neither intubation nor tracheotomy is of any effect.

ASTHMA.

Definition.—This is a paroxysmal dyspnea, either associated with bronchitis, or in which there is no evident pathology of the lungs or bronchi.

Etiology.—A serious difficulty arises in the lack of agreement as to what constitutes asthma. In children there are four fairly distinct varieties, two of which are peculiar to children, and especially infants and very young children. These are not accepted as asthma proper by many writers.

First, the cases with the predominant nervous element, the same as occur in adult life, having a hereditary tendency, often of parental gout or severe neurosis. Second, the periodic form known as hay fever. Third, cases which usually consist of a single attack, and follow whooping-cough, or severe bronchitis; this is the common form and is often called spasmodic bronchitis or catarrhal spasm of the bronchi. Fourth, attacks similar to acute bronchitis, with the added feature of very severe dyspnea and prostration.

The two latter are typical of childhood. They are most apt to occur in children with nose or throat trouble, rhinitis, adenoids, etc. Children with the exudative diathesis are especially prone to the attacks. First attacks nearly always follow bronchitis. An acute intestinal disturbance may usher it in. Enlarged bronchial glands may rarely be the cause.

Symptoms.—There are usually the symptoms of the antecedent bronchitis. Rarely it is an ordinary acute bronchitis of the severer type, more commonly it follows a prolonged bronchitis of any sort. The asthma comes on suddenly, oftenest at night. There is intense air-hunger, and the child sits up, throws back the head, and exerts to the fullest the muscles of respiration. There is a little, or rarely very marked cyanosis; in infants there may be alarming prostration. Breathing is rapid, noisy, and has a distinct, diagnostic wheezing sound. The nostrils dilate, and the child presents evidences of extreme distress. Speech is difficult and may be impossible. In infants the chest is usually filled with some moist and many subcrepitant rales. Other signs depend on the bronchitis, if it is still present.

The first form clears up in a few hours, and the child is quite comfortable; but in young infants death sometimes occurs in the attack. The second form presents remissions and recurrences for perhaps many weeks or months. A single attack may last for a whole day, or several days.

The attacks of the adult type and of hay fever have no special points of differentiation from the ones that exist in adults. The diagnostic feature is the intense dyspnea with the loud, wheezing respiration.

Prognosis.—In the types peculiar to children the prognosis is good, except for the fact that occasionally small infants die in an attack. Complete recovery and the prevention of recurrences depends on the cause. The adult types have a poorer prognosis, as it is often difficult to do anything to prevent them, and recurring attacks may result in serious weakening, due to loss of sleep, deformities of the chest, etc.

Treatment.—Any abnormal condition that can be considered as an exciting cause should be looked for and corrected. Other signs of the exudative diathesis should be kept in mind and looked for at different times. This is especially important when the child has repeated attacks. The best of hygienic conditions should be instituted and if possible a suitable climate found for the child.

During the attack the best treatment is the inhalation of the fumes of saltpetre paper, or the smoke of burning stra-

monium leaves or cigarettes. In severe attacks the hypodermic injection of epinephrin, 5 minims to a child of three years, often gives marked relief. In first attacks the injection of a very small dose of morphin and atropin will give great relief; it is best not used in repeated attacks.

For the recurring attacks various combinations of belladonna, potassium iodide and ammonium chloride are of some value. Antipyrin and chloral, in full dose, will sometimes prevent an attack, if one is anticipated, by giving them at bedtime.

The adult form, and possibly the so-called spasmodic asthma, has been the subject of considerable accurate observation from the view-point of bacterial infection. Babcock has reported numerous cures of otherwise completely resistant asthma by the use of vaccines prepared from the sputum. Others have had similar results. It is certainly worth trying.

PULMONARY EMPHYSEMA.

Definition.—This is a dilatation of numerous air spaces of the lungs, usually producing enlargement of certain portions of the lungs. Very rarely is there enlargement of the lungs as a whole, as is the case in adults.

Etiology.—Emphysema is always secondary to some other condition. In one class of cases it is called compensatory, as a portion of the lung becomes overdistended because some other portion is unable to perform its function; this occurs in pneumonia, chronic pleurisy with adhesions, etc. The other sort of conditions consist of those in which there is obstruction and difficult expiration; all forms of stenosis of the larynx and trachea, or in diseases accompanied with severe, prolonged cough, as chronic asthma and pertussis.

Pathology.—The lesion of emphysema of childhood is a moderate enlargement of the air vesicles in several areas, with perhaps a few places in which they have ruptured and the air escaped into the cellular tissue. It is most frequent in the anterior borders of the upper lobes. With severe laryngeal stenosis it may affect nearly the whole of both lungs. Sometimes ruptures of considerable size take place, causing inter-

stitial or mediastinal emphysema. The emphysema of children is called vesicular, as the infiltrating form is practically never seen in children.

Symptoms.- Of the emphysema itself the only diagnostic point is the increased resonance on percussion. It is very uncertain as a means of diagnosis, and the condition usually can only be suspected. If any considerable area is involved, there may be feeble breath sounds and prolonged, low-pitched expiration.

Prognosis.—This is good, if the original disease is cured. The emphysema entirely disappears.

Treatment.—There is no treatment other than that for the disease which causes it.

REFLEX COUGH.

Definition.—This term, or nervous cough as it is sometimes called, is coming to be largely used to designate the great number of coughs occurring without demonstrable abnormality of the larynx, lungs, or pleura. All coughing is to a certain extent reflex in character. But in many cases we must establish a connection between the cough and abnormality of some part distant from the respiratory tract. We then assume that it is due to irritation of the vagus nerve, communicated to the nerve by some distant branch. The distribution of the vagus to the ear, the heart, the stomach, etc., makes it the most probable solution.

The most frequent cause is chronic disease of the nasopharynx, especially adenoids or lingual tonsillitis. Elongated uvula sometimes is the cause, and the cough may be very annoying. Cough is not infrequently due to pulmonary congestion from heart disease; it is not rare for the physician to be consulted for a persistent cough, and find that it is the first noticeable symptom of mitral stenosis. Enlarged bronchial lymph glands sometimes are the cause of a cough that is quite characteristic. It occurs in sharp paroxysms, often severe, usually at night, and perhaps at about the same time every night for weeks. This cough is apt to have a peculiar metallic sound. Another variety occurs about the time of puberty,

most often in girls, and associated with some nervous condition. It is particularly apt to occur during exercise or excitement of any kind.

Symptoms.—In the first place there is established the certainty of no trouble in the respiratory tract. Then a possible cause may be found in enlarged tonsils and adenoids, or valvular heart lesion, the symptoms of which are manifest. Usually the cough is worse at night, and often only when the child lies in a certain position. Infants are rarely affected; most of the cases are over four years old. The general health does not suffer, unless from the disease which causes the cough. Restless nights may result in irritability during the day, and the child seem ill in consequence.

Treatment.—The cause of the condition must be found if possible, and removed. When assured that there is no organic trouble that needs correction, we should try to determine whether or not the cough is a matter of habit. Some bitter, disagreeable mixture may then correct it. If it is decided that the cough is of nervous origin it is wise to use a sedative, preferably the bromides, and so arrange the manner of living as to help the nervousness. Narcotic and expectorant cough mixtures should not be used.

BRONCHOPNEUMONIA.

Definition.—This is an inflammation of the lung resulting in consolidation of parts of it, and usually distributed in patches throughout both lungs. It is also called catarrhal, or lobar pneumonia. It is extremely common in childhood, particularly in infancy, and has come to be thought of as the pneumonia of childhood. Fully three-fourths of the cases of pneumonia in infants under two years are of this variety.

Etiology.—It is always an infection, but may be due to any one of several bacteria. Most common are the staphylococcus, pneumococcus, and streptococcus; less often the bacilli of influenza and diphtheria. Only about one-third of the cases are primary, the other two-thirds following some acute infectious disease, as acute bronchitis, measles, pertussis, influenza, severe acute intestinal disease, or less often

any sort of severe infection. In the great majority of cases the children are delicate, undernourished, or badly cared for; but this is much more noticeable in the secondary cases, as the primary is nearly as frequent in the robust as in the delicate. The greatest number of cases occur during the late autumn, winter, and spring. Exposure to cold, particularly when associated with tiresome exertion, is a prolific cause.

Pathology.—The condition of the lungs varies greatly according to the length of time the disease has existed. The distinctive lesion is the inflammation of the air vesicles and lobules, in which the entire thickness of the wall is affected and the interior filled with leukocytes, epithelial cells, red cells and fibrin; this is the cause of the consolidation. Surrounding such areas the tissue is usually somewhat infiltrated and congested. All degrees of involvement may occur. There may be an intense congestion of both lungs, with countless small consolidated areas which are difficult to see with the naked eye; these are the cases that have died after only two or three days of illness, or even less. More commonly there is extensive involvement of the base of both lungs posteriorly with easily visible patches, or perhaps almost an entire lobe. The lung then has a mottled, red and gray appearance; such cases have a course of five to ten days. More protracted cases show great involvement of both lungs with thickening of the bronchial walls, usually considerable pleurisy, and marked emphysema. Section of the lung is nearly uniformly gray. Often the alveolar walls are much infiltrated and thickened, with interstitial scar formation after recovery.

All degrees of bronchitis, emphysema, pleurisy with or without adhesions, pulmonary abscesses, gangrene, or pleural effusions, may be found as complications.

Symptoms.—The ordinary type of bronchopneumonia has a less sudden onset than the lobar form, the temperature rising irregularly for a couple of days and being subject to marked daily remissions. Nearly always the symptoms point to the lungs as the seat of the trouble, which is not by any means always the case in lobar pneumonia. There is considerable cough, rapid respiration, prostration and often slight cyanosis. The pulse is rapid and soon becomes soft

and readily compressible. The respiration is apt to be very rapid, labored, and accompanied by a short expiratory grunt; the rate is from 50 to 80 per minute. A valuable symptom is the expanding of the nostrils with each inspiration. The cough is short, dry, and very often painful and suppressed.

The fever may go to 103° or 104° F., but usually runs irregularly from 101° to 103° F. After the disease is well established, the picture is usually quite characteristic, and often the condition can be strongly suspected at a glance. The face is flushed or slightly cyanotic, the lips and mouth are dry. The cough is frequent, short and distressing, and the child fretful and restless. The nostrils dilate in inspiration, the chest walls and soft parts above and below retract, and there is no doubt about the child being seriously ill.

Often the prostration is extreme, the child being in a stuporous condition; delirium or, late in the disease, convulsions may occur. Diarrhea is a frequent symptom, especially in infants, and is an unfavorable one; it is much more frequent in attacks during the summer.

If recovery takes place, a gradual improvement in all the symptoms is noticed. The course is about two or three weeks.

Physical Signs.—These are not nearly as important or as valuable for diagnosis as the symptoms, except those evident by inspection. Most important is the presence of many moist rales all over the chest, especially at the bases posteriorly, and here and there the fine, subcrepitant rales coming at the end of inspiration. The latter are distinctive, but are not always heard, particularly in very acute cases. If there is considerable consolidation near the pleura there is an area, or several areas, of relative dulness on percussion, the voice sounds are much accentuated, the breathing sharp but not much exaggerated, but becoming true bronchial breathing with frank consolidation. It is surprising how often these manifest signs are absent. Frequently there is a pleuritic friction rub, but great care must be taken not to confound the many coarse mucous rales with this pleural sound, as they may be very similar.

In a class of cases called sometimes *capillary bronchitis* the course and signs are different. The onset is sudden, with high

fever, very rapid, labored breathing, incessant cough and usually cyanosis. The signs of consolidation are not present, the lungs being full of moist rales of all degree, but always the typical subcrepitant rales in places. The respiratory sounds are decreased. The child may die in this condition, or after a few days develop the ordinary type above described.

There is still another type, most common in young infants, characterized by very sudden onset, high fever of 104° to 106° F., extremely rapid breathing, prostration and cyanosis. Usually there is stupor or marked apathy. The child may die in a few hours without any other symptoms, and with no physical signs of pneumonia. The diagnosis is extremely difficult, usually being made postmortem. It is nearly always fatal. Rarely the symptoms rapidly subside and in a few days the child is well; rarely, also, it passes into the ordinary form of bronchopneumonia. These cases are called **acute congestive bronchopneumonia.**

Diagnosis.—From bronchitis the diagnosis often cannot be differentiated until the fever has existed several days; this does not occur in bronchitis. Diagnosis must depend on the fever, rapid breathing, cough, prostration, and the presence of the fine, crackling rales. When consolidation can be made out there is no doubt, except as to the possibility of lobar pneumonia. Often it is impossible to differentiate the two. Here the history of rather slow onset, irregular fever, perhaps the preceding disease, the very distressing cough, and the manifest involvement of scattered areas in both lungs, must be depended upon. The leukocyte count is high in both diseases, but is more consistently high in lobar pneumonia, especially in older children. And the lobar form occurs much less frequently in infants and very young children. In the protracted cases one should always bear in mind tuberculous bronchopneumonia.

Prognosis.—A serious prognosis must always be given. The younger the child, the greater the danger. Previous health or disease is an important factor. Following measles, pertussis, diphtheria or scarlet fever, or any severe acute illness the outlook is very bad, and also if there is a preceding severe bronchitis. The mortality in the primary form is much less.

In children under three years about two-thirds of the cases are fatal.

Treatment.—Careful measures should be taken in all cases of bronchitis and the acute infections to prevent the development of pneumonia. Rest and quiet, attention to diet, bowels, preventing exposure, etc., will prevent its development in many cases.

The room temperature, diet, and general care is much the same as that in acute, severe bronchitis. The diet should be nutritious and easily digestible, care being taken not to overload the stomach. The child should not be allowed to lie for long in one position, as this favors hypostatic congestion of the dependant portion of the lungs. In severe cases of acute onset, high fever, and great prostration it is best to have the temperature of the room about 70° F., and not try the cold, fresh air treatment. With more protracted cases the more fresh air the better, as long as the child is kept comfortably warm.

The cough is best relieved by inhalations of drug-laden steam, as described under Bronchitis. If it is so incessant as to keep the child from resting, small doses of paregoric may be used to insure a period of rest. Often the cough is lessened by the use of a mixture of turpentine one-third and camphorated oil two-thirds, applied to the chest and covered with the oiled silk jacket; this is a good routine measure. The amount of turpentine may be increased if no burning occurs.

The fever will seldom need any treatment. If it does, the use of cold, either the ice-bag, cool enema or cool sponge or pack may be employed. These measures often allay the restlessness as well.

Great prostration and cyanosis are danger signs that are best met by means of the mustard pack or hot mustard bath. One-third or one-half mustard may be used as a paste or one ounce to the gallon of water for the pack or bath; this may be used from two to six times daily. Free use of caffein, camphor and strychnine may be of assistance. Alcohol is a valuable remedy when the need for constant stimulation is evident. One ounce of whisky or brandy in twenty-four hours may be given to a child of a year, in doses two hours apart. The use of nitroglycerin and of atropin are of doubtful value.

It is usually wise to give an effective laxative in the beginning of the disease, and repeat it at intervals of three or four days if indicated. Otherwise the fewer drugs used the better. Small doses of antipyrin or phenacetin, perhaps combined with bromide, may be used for the restlessness but should not be used to control the temperature.

When the disease has run a course of two weeks or more, the main reliance must be placed on fresh air, nourishing food, perhaps a change of climate in protracted cases. In the protracted cases, and particularly during convalescence, a course of general tonic treatment is indicated, either with iron, cod-liver oil or arsenic. Small doses of creosote are often of value.

LOBAR PNEUMONIA.

Definition.—This is an acute infectious disease in which there is massive consolidation of a large part, or the whole, of one or more lobes of the lung. It is also called croupous or fibrinous pneumonia.

Etiology.—It is comparatively rare in infancy, but may occur at any age. It becomes more frequent in the second and third years, and after that age the great majority of the primary cases are lobar. The secondary cases are much more frequently lobular.

It occurs much more frequently in the late winter and early spring, and is quite rare in the hot weather. Prolonged chilling, exposure to severe cold, particularly when the child is fatigued, wet clothes not quickly changed, are the most frequent exciting causes. There is abundant evidence that the disease is slightly contagious, and apparent epidemics have been reported from time to time.

The specific cause is the Diplococcus pneumoniæ of Fränkel. This can be demonstrated in the lung in the great majority of cases, and can usually be cultivated from the blood, showing a general pneumococcus septicemia. The staphylococcus or streptococcus, and less often other organisms, may be associated with it, and in rare cases the pneumococcus cannot be found.

Previous disease or state of health has nothing to do with

its incidence, healthy children being attacked in the majority of cases.

Pathology.—In the great majority of cases only one lobe of one lung is affected; oftenest it is the lower lobe; two or more lobes may be involved, in one or both lungs.

The stages of the disease are the same as in adults. First, the congestion, in which the part is dark red and edematous. Second, the red hepatization, in which the tissue is solidified, dark red, and swollen; on cut section it resembles liver substance; the pleura over the affected portion is usually thickened and covered with a fibrinous exudate. Third, the gray hepatization, in which the lung is still solid, but more moist, and the inflammatory products being absorbed or decolorized. Fourth, the stage of resolution, in which the inflammation subsides, the inflammatory products being removed by absorption and expectoration. The tissue is softer, very moist, and quickly returns to normal.

In the first stage the microscope shows dilatation and engorgement of the bloodvessels, and a serous exudation in the lining of the alveoli and into the air vesicles. In the second stage the alveoli are distended with a fibrinous exudate, and contain many red cells, leukocytes, and epithelial cells. In the third stage the condition is much the same, but the vessels are less engorged and the red cells destroyed.

Any one of these stages may last from one to several days. Congestion usually only a day, sometimes only a few hours. Red hepatization usually lasts three or four days, perhaps a week or more. Gray hepatization often lasts only one or two days, and resolution about the same time; resolution may be delayed for many days, but nearly always begins when the temperature falls to normal.

The consolidated portion probably always touches the pleura at some point, in fact, nearly always begins at the pleura, and pleurisy is a constant lesion. True central pneumonia is exceedingly rare.

Pleural effusion, empyema, gangrene of the lung, extension to the pericardium, meningitis, peritonitis, and other lesions due to the pneumococcus may be present. When death occurs, there is generally marked distention of the right heart,

Symptoms.—The disease usually begins, after a very short period of general malaise, vomiting, etc., with a chill or chilly sensations and a very rapid rise in temperature, to 103° or 104° F. Quite frequently there is a sharp pain in the side of the chest. There is usually only slight cough, somewhat painful. The face is flushed, mouth dry, the child is restless and fretful. The pulse is rapid, full, and strong. The cough soon becomes more frequent and very painful, with no expectoration; usually there is not such an incessant cough as in bronchopneumonia.

Within a few hours the child may become delirious, the tongue is thickly coated and the lips parched, food is refused, the pain very severe, and the child does not lie quiet a minute; all this may exist without any delirium.

After the second day the child is usually more comfortable, but all the symptoms keep up very much the same for about a week, as a rule. During this time the cough is somewhat looser and the sputum is thick, sticky, and so stained with blood as to be reddish brown, the "rusty" sputum. The temperature remains high all the time, with variations of only one or two degrees.

Improvement usually comes after a prolonged, quiet sleep, such as the child has not had during the illness. The temperature drops sharply, often going to normal through the day and not recurring. All the symptoms subside and the child is comfortable, the appetite returns, and convalescence is established.

Danger signs are pallor or cyanosis, marked delirium, thready pulse, diarrhea, and lack of accentuation of the second pulmonic heart sound.

Physical Signs.—Inspection shows the flushed face, frequently more flushed on the side of the consolidation, rapid respiration with a decided expiratory moan or grunt, and retraction of the soft parts of the thorax, and nostrils dilating with each inspiration.

The ratio of pulse to respiration is 3 or 2 to 1, instead of the normal 4 to 1.

Usually there is lessened movement of the chest wall on the side of the consolidation. The breath sounds are much

diminished, sometimes scarcely heard at all, and in the early stages generally no rales can be heard. Breathing over the

FIG. 12.—Shadow showing consolidation touching pleura but not reaching to hilum; no bronchial breathing nor bronchial voice sounds. (Article by Howard A. Mason.)

rest of the lung is intensified. There is relative dulness over the affected part. This may be slight in the beginning, but

careful percussion will elicit it in practically every case; this is often the most valuable early sign.

No other signs may manifest themselves until the second, or even the fifth day. Usually by the second day the typical

Fig. 13. Showing shadow reaching to hilum. Bronchial breathing and voice sounds present.

pneumonic crepitus, occurring at the end of inspiration, can be heard; it is apt to be a transient symptom, perhaps present only a few hours. Any time later, sometimes as late as the fifth day, frequently the fourth, the signs of consolidation

appear. There is increased fremitus and sharp, high-pitched breathing in which the sound seems right under the ear; this is bronchial breathing, and once heard, it is never easily mistaken. Voice sounds have the same clarity, and the impression of being produced close to the ear. The dulness becomes much more marked, being often almost flat over an entire lobe. Often pleuritic friction sounds are heard. During this period there are usually no rales.

The signs of complete consolidation depend on solidification of the lung from the pleura to the hilum. Therefore it is in most cases four days, or even five or six, before the typical signs of consolidation appear, as the process probably always begins adjacent to the pleura. This point should be borne in mind, and more dependence placed on moderately diminished resonance and the inspection, pulse, respiration, fever, rales, etc.

During resolution there is a rapid subsidence of the signs and the reappearance of the inspiratory rales, called crepitus redux, or the crepitus of resolution.

Complications have been mentioned under Pathology. By far the most common one is empyema; simple pleurisy is so constant that it can hardly be considered as a complication. Empyema is suspected if the high temperature recurs, or is unduly prolonged, and with it a flat percussion note over nearly the whole lung, decreased sounds, displacement of the heart, and lessened or absent fremitus. The signs are often extremely difficult to properly interpret, and puncture should be performed in every doubtful case.

From bronchopneumonia the differentiation is easy in most cases; sometimes it is exceedingly difficult, or impossible. Careful observance of the differences in cause, onset, course, location, etc., is necessary to decide which form is present.

Prognosis.—This is very good in uncomplicated cases. From the pneumonia alone the mortality is only about 5 per cent. The great danger is from heart failure, which is heralded by all the evidences of failing circulation and prostration; particularly important as a signal of this is the weakening of the second pulmonic heart sound, which is sharply accentuated when the heart is beating effectively.

Treatment.—The child should be kept absolutely quiet in bed from the beginning. Fresh, cool air, obtained by having windows wide open, is of prime importance. Water should be given freely at all times, and a liberal, nourishing diet. For the first day or two it often is difficult to feed a child, and too much stress should not be laid on nourishment during that time. Pain in the chest is often relieved and the child made more comfortable generally, by the use of the mustard paste or turpentine and oil, as described under Bronchopneumonia the mustard is also valuable during signs of heart failure. The temperature usually needs no attention. If it is unusually high and the child very restless and sleepless, the best means of reduction is the use of cool water in various ways. The antipyretics should not be used for fever reduction. Great pain or excessive cough must sometimes be allayed by opium, in just sufficient amount to give relief. Sometimes excessive restlessness is best controlled by trional, bromide or phenacetin.

Stimulation is not usually indicated until about the time for the crisis and afterward; often it is not indicated at all. Considerable doubt has been raised as to the efficacy of any of the widely used stimulants. But experience seems to show the decided benefit of alcohol used as in bronchopneumonia. Camphor and caffeine can be used hypodermically, and both undoubtedly are effective; their effect is likely to be very transient, and they can be used every two hours. Epinephrin is often very valuable in sudden collapse; it may be used in injections of 2 to 4 or 6 minims. Oxygen is also of value in marked respiratory distress with cyanosis.

When improvement begins in lobar pneumonia, convalescence is in the great majority of cases short, recovery complete, and little assistance of any kind is needed. If there is poor appetite, evident weakness, etc., a general tonic treatment is indicated.

INTERSTITIAL PNEUMONIA.

Definition.—This is a chronic inflammatory process involving the connective-tissue framework of the lung and bronchi.

It is also called chronic bronchopneumonia; from the fact that it is generally associated with pulmonary tuberculosis it is often called fibroid phthisis.

Etiology.—It is usually a manifestation of pulmonary tuberculosis. Other cases probably always follow attacks of acute bronchopneumonia, and are most apt to occur in infants and young children. It is rather a rare condition.

Pathology.—There is a marked increase in the connective tissue, usually occurring in patches irregularly distributed throughout one lobe, much less often in two or more lobes. The affected bronchi are often much dilated if the process is far advanced, and they may form cavities of considerable size; this condition is called bronchiectasis. The pleura is much thickened and forms dense adhesions with the costal pleura, limiting the movement of the lung. The affected lung is small, firm, and tough. Much of the alveolar tissue is destroyed. There is marked compensatory emphysema.

Symptoms.—These are very indefinite. There is usually the history of acute bronchopneumonia. Following this the child improves to a certain point. The cough persists, there is apt to be dyspnea on exertion, and sometimes sharp, fleeting pains in the chest. If there is much bronchiectasis the sputum is profuse and foul. There is no fever. The child is up and about, but does not gain in flesh and strength. Examination shows definite dulness, nearly always over one lobe. The breath sounds are feeble, often remarkably so. Unless the case is tuberculous there are not apt to be rales. In a well-advanced case there is retraction of the chest wall on the affected side. Pleural adhesions may cause marked displacement of the heart. The course is very chronic, and typical signs may not develop for many months. If the case is tuberculous, the bacilli can nearly always be demonstrated in the sputum. There is nothing else characteristic about the tuberculous variety.

Prognosis.—The affected portion of the lung never returns to normal; this prevents a child from developing robust health in probably every case. Attacks of acute pneumonia are very frequent and eventually the children die of such attacks. The prognosis in the tuberculous form is absolutely

bad. The disease lasts for many months, and often for many years.

Treatment.—The best of hygienic conditions and, if possible, a change to a warm, equable climate, are the only means of any special value. Various measures for the relief of the cough may be tried, as stated elsewhere. The greater part of the time should be spent out of doors. Cod-liver oil, with or without creosote, is of particular value as a tonic. If there is bronchiectasis with distressing cough and large quantities of sputum, inhalations of creosote-laden steam will at times improve the symptoms.

PULMONARY GANGRENE.

Definition.—This is a localized necrosis of lung tissue.

Etiology.—It is a rare condition, being found less often in older than young children. It occurs practically always secondary to pneumonia, less often following a general sepsis; of the acute infections it occurs oftenest following measles. Healthy, robust children very rarely develop this complication in any illness. The immediate cause is thrombosis or embolism of some branch of the pulmonary artery, shutting off the circulation in that part of the lung.

Pathology.—The lower lobes are affected much more often than the upper. The whole lobe or the whole lung may be affected; or the process may be distributed in patches in both lungs, always being near the surface. The latter is much the commoner form. There is always thrombosis of the artery leading to the part, and the gangrenous portion is wedge-shaped, with the base toward the pleura. These areas are of a greenish color and have an intensely foul odor. In the diffuse form the individual patches may not be very noticeable on inspection.

Symptoms.—Those of the primary disease are always present and mask the evidences of gangrene. Usually the diagnosis is made postmortem. The only symptoms characteristic of the condition are the very foul breath and the expectoration of necrotic tissue; rarely there is hemorrhage from the lungs. None of these symptoms is present until

gangrene is well advanced, and most cases die before this time. Such children are usually in a comatose condition from the severity of the original disease. The physical signs are not at all distinctive.

Prognosis.—It is doubtful if a case of pulmonary gangrene ever recovers, and there is certainly no way of finding it out if one does.

Treatment.—Proper nourishment and stimulation are indicated, as in the treatment of the disease causing the gangrene. The inhalation of the fumes of creosote or turpentine is the best means of lessening the foul odor of the breath, though it can have no curative effect.

ABSCESS OF THE LUNG.

Definition.—This is a collection of pus within the tissue of the lung, due to localized suppuration following some sort of injury.

Etiology.—It is a rare condition, and particularly so in children; the tuberculous abscess is not considered here. Nearly always the abscess is the result of acute pneumonia, or a foreign body being carried into a small bronchus from which it cannot be extracted.

Pathology.—There is a single closed cavity filled with pus. It may be anywhere in the lung but is rare at the apices. The lung tissue is destroyed and the wall of the cavity is necrotic and infiltrated with pus. Rarely there is a limiting pyogenic membrane. If near the pleura, there is a fibrinous pleurisy, empyema, or the abscess may rupture into the pleura, resulting in a pyopneumothorax. It may rupture into a bronchus and the pus be coughed up. When secondary to pneumonia, the organism is nearly always the pneumococcus; traumatic or aspiration abscess may be due to several pus organisms.

Symptoms.—These are so similar to empyema that usually a correct diagnosis is not made—dulness, lessened fremitus, feeble breath sounds, often a pleuritic rub and coarse, moist rales. The fever is high but irregular, and sweating is common; there is severe cough, often pain in the chest, and poor appetite, restlessness, and the many evidences of severe ill-

ness. Weakness and wasting are marked. Generally the diagnosis of empyema is made, puncture locates the pus, and operation reveals the true character of the trouble. The leukocyte count is very high, but it is also in empyema.

Prognosis.—This is fairly good if the pus is promptly evacuated, and no other serious condition is present.

Treatment.—Stimulation and supporting measures of all sorts are indicated. But there is no treatment of the condition other than surgical removal of the pus and efficient drainage.

ACQUIRED ATELECTASIS.

Definition.—This is a condition in which the alveoli of the lung collapse, presenting the state of the lung in fetal life.

Etiology.—It may be due to compression of the lung or to prolonged obstruction of the respiratory passages. The first is most often due to pleuritic effusion. Pneumothorax, pericardial effusion, extreme cardiac enlargement, marked chest deformities, or large mediastinal tumors, may be the cause in rare instances. Obstruction is due to occlusion of a bronchus by a foreign body, or pressure from enlarged lymph nodes; the amount of atelectasis depends, of course, on the size of the bronchus, a whole lobe or a whole lung being possibly affected. In very weak, debilitated children there occurs a form of atelectasis due to swelling and occlusion of the tubes from bronchitis or bronchopneumonia; it comes on very gradually, is an essentially chronic inflammation, and nearly always shows some degree of pneumonia.

Atelectasis may occur at any age. It is more frequent in children, and the last-mentioned variety occurs almost exclusively in infants.

Symptoms.—Dyspnea and cyanosis, with lack of expansion or even marked retraction of portions of the chest wall, are the distinctive symptoms. There is no fever. There is a feeble respiratory sound and more or less dulness over the affected part. In long-standing cases the lung may become very compact and give the signs of consolidation. The symptoms and signs of the disease causing it must be considered.

Diagnosis.—Diagnosis is difficult unless a large area is involved. It is not usually recognized during life.

Prognosis.—Prognosis is poor, as it is usually evidence of serious disease elsewhere, or the child is in poor physicla condition.

Treatment.—This consists in removing the cause, if possible, and taking measures to dilate the collapsed portion. Fresh air, oxygen in severe dyspnea, very hot baths, or mustard baths, all are of assistance. Expansion after the cause has been removed, as in pleural effusion or foreign body, may be assisted by having the child blow bubbles, blow colored water from one bottle to another, etc. Stimulation and general tonics are often indicated.

DRY PLEURISY.

(Pleuritis.)

Definition.—This is an inflammation of the serous covering of the lung in which there is a thick exudation on its surface with little or no fluid.

Etiology.—By far the commonest cause is acute pneumonia, resulting in the acute pleurisy. It may accompany the acute infections, particularly influenza, scarlet fever, typhoid, measles, and rheumatism. Occasionally it follows exposure to cold, or injuries to the chest, without any known inflammation elsewhere. Less acute attacks, or those essentially chronic, are generally due to tuberculosis of the lung.

Pathology.—The pleura is roughened, dull and uneven, usually over an area of lung consolidation. The lung pleura is first affected but the adjacent costal pleura is soon involved. There is soon a layer formed composed of fibrin, leukocytes, and connective-tissue cells. This may be very thin and easily detached, or may be an eighth of an inch thick and firmly attached by organized tissue to the pleura and lung. Healing nearly always results in more or less permanent adhesions between the two surfaces; sometimes both lungs are firmly bound to the chest wall. The tuberculous form is more chronic, the thickening often extreme, and the typical path-

ology of tuberculosis always present. Encapsulated fluid often is encountered.

Symptoms.—There is a sharp, sudden, cutting pain on the side of the chest affected, often not very definitely localized. Breathing is painful and is controlled as much as possible. There is a short, painful cough which the child tries to control. If the diaphragmatic pleura is involved, the pain may be entirely referred to the abdomen, which is rigid and tender. Fever is moderate and of short duration. The diagnostic sign is the friction rub, a grating, crackling sound heard both in inspiration and expiration. This makes the diagnosis.

Prognosis.—The disease runs a course of four to eight days, and subsides completely. It is not a fatal condition.

Treatment.—The child can often be made more comfortable by strapping the affected side with adhesive plaster. This must be done during expiration and extend well across the middle line, front and back, in order to lessen the movement. Morphin may be needed to control the pain. Strong counter-irritation by mustard or iodine will occasionally shorten the process. The diaphragmatic variety can be aided only by the use of analgesics.

PLEURISY WITH EFFUSION.

Definition.—This is an inflammation of the pleura with a free fluid exudation, resulting in a considerable amount of serum in the pleural cavity.

Etiology.—Tuberculosis is the most frequent cause, and it is remarkable that in a great many cases no other tuberculous lesions can be found in the body, even postmortem. Next in frequency is acute pneumonia. Of the infections, typhoid, scarlet fever, and rheumatism are rare causes; it may occur in any acute infection. Trauma sometimes is a cause. Rarely it is a primary infection, following severe exposure. The tubercle bacillus, pneumococcus, streptococcus and staphylococcus are the organisms generally found. The pus organisms sometimes cause an infection in a pleural transudate due to nephritis, heart disease, etc.

Pathology.—Usually only one pleural cavity is involved; both may be. The early lesions are the same as in dry pleurisy. But soon there is a free pouring out of a serofibrinous fluid, translucent and straw-colored. Usually it contains flakes of fibrin, especially in young infants; and it may become turbid and purulent, resulting in empyema. Tuberculous effusions may be red from the presence of blood. There may be only a few ounces, or the entire cavity may be filled and the lung firmly compressed.

Symptoms.—The early signs are those of dry pleurisy. Very soon the pain and friction rub disappear and the signs of fluid are found. If it comes as a complication of other disease, the previous symptoms mask it. When primary, the symptoms are those of a mild pneumonia, but with very severe pain. If the fluid is very large in amount and has accumulated rapidly, there may be decided dyspnea, cyanosis, and alarming prostration. If it accumulates slowly, there are few pressure symptoms. Simple pleural effusion tends to absorb if left alone. Tuberculous cases may be persistent and recurrent. Empyema is apt to develop in any variety.

Physical Signs.—When the fluid forms, the characteristic signs are lessened movement of one side of the chest, with perhaps a fulness of that side. Over the fluid the percussion note is flat, the fremitus diminished or absent, and the breath sounds feeble or inaudible. If the lung is consolidated behind the fluid, the fremitus, breath and voice sounds may be much as they are in consolidation without effusion; but the flatness is characteristic. Rarely there is a shifting dulness in different positions of the body; this is not a reliable sign.

Above the fluid the breath sounds are apt to be harsh and exaggerated. The apex beat of the heart is displaced if the effusion is large. This occurs much more strikingly when the effusion is in the left pleura, but also with a large effusion in the right. The *x*-ray shows a characteristic shadow with ordinary effusion.

Diagnosis.—This is easy in a typical case. Only the exploring needle will tell whether or not the fluid is purulent. Over consolidated lung it may be very difficult to decide, as

the signs may be those of consolidation, except for the flat note on percussion. The needle is the only definite means of diagnosis, and it should be used in every puzzling case.

Prognosis.—Recovery is the rule. The dangers are the occurrence of suppuration, the possibility of tuberculosis, and the very rapid effusion of a great amount of fluid.

Treatment.—In the dry stage the treatment has been considered. With the onset of fluid the patient is much more comfortable, but should be kept in bed. The diet should be light and the fluids restricted. Free catharsis is advisable, as are diuretic drugs, as caffein, diuretin, and digitalis. When improvement is noticed, the amount of exertion is to be carefully limited for several days or weeks.

If the fluid is accumulating so rapidly as to embarrass the child, a part of it should be withdrawn; only enough to produce marked relief should be aspirated. Or this may be done when a week or two has gone by without noticeable lessening. Often, then, absorption rapidly takes place. Repeated tapping may be necessary, but it is wise to do it as infrequently as possible.

After recovery many weeks should elapse before the child is allowed to run and play as usual, and some general tonic treatment is usually advisable.

EMPYEMA.

Definition.—This is a pleural effusion due to infection by a pyogenic organism, resulting in a collection of pus in the cavity.

Etiology.—As mentioned above, any pleural effusion may become purulent after it has formed. The cause in the great majority of cases is an extension to the pleura of a pneumonia, resulting in a pneumococcic empyema. Scarlet fever, measles, influenza, or any acute infection may be complicated by empyema; trauma, or any pus process in the neighborhood, as peritonitis, subphrenic abscess, etc., may be the cause. Tuberculosis is not a frequent cause until about the eighth year and after. The commonest organisms are the pneumococcus, streptococcus, staphylococcus, and tubercle bacillus.

Pathology.—The process is essentially the same as in serous effusion, but the product is largely pus, with fibrin and serum. Adhesions are formed at first, but the accumulating fluid breaks them, and the fluid is found at the bottom of the cavity in the great majority of cases. If only a small portion of the pleura is affected, the adhesions may hold the fluid in one place, the so-called encysted empyema. Usually the fluid extends from the bottom to nearly the top of the lung, only an inch or so of fluid separating it from the chest wall in most places. The lung is therefore moderately compressed from all sides, and does not float on the surface of the fluid. Sacculated fluid is generally posterior, but may be at any part of the pleura. Very puzzling are the cases where the fluid is between two lobes and does not touch the parietal pleura. This is a rare situation.

There is no tendency for the pus to absorb.

Symptoms.—Following the symptoms of the preceding disease the temperature remains high instead of falling, as the progress of the disease would indicate. The temperature is apt to fluctuate markedly, and sweating, with chilly sensations is common. There is considerable cough, rapid breathing, rarely marked dyspnea or cyanosis; these are apt to be the only signs in infants. Weakness, loss of appetite, rapid wasting and anemia rapidly develop. The leukocytosis is very high (30,000 to 60,000) and of the polynuclear variety.

If the pus is not evacuated, these general symptoms continue, with progressive weakness and emaciation. The pus tends to burrow, and may rupture into the lung, or externally through the chest wall (empyema necessitatus); very rarely it ruptures into the peritoneum, esophagus, etc. The pus may remain for months unsuspected and the child recover perfectly when it is recognized and evacuated.

Physical Signs.—These are identical with those of pleural effusion, but the fluid is oftener sacculated and confined to one area.

Diagnosis.—Many cases will be overlooked, especially in infants, unless the exploring needle is used in every case of flatness or persistent dulness over some part of the pleura. In the cases with consolidated lung behind the fluid the signs

may be so similar to those of consolidation that only the needle will differentiate. The flat note is very important. The *x*-rays are invaluable in obscure cases. Interlobular empyema is particularly puzzling because the needle may have to be inserted very far in and in a very definite locality in order to reach the pus. The leukocyte count of 30,000 or more should make one suspect pus. Displacement of the heart is exceedingly valuable; especially to differentiate from pericardial effusion.

Prognosis.—In young infants the mortality is high, even when the pus is evacuated early. The danger decreases with the age. The most favorable cases are those due to the pneumococcus and staphylococcus; streptococcus infection is much more serious; tuberculous cases have a very bad prognosis.

Treatment.—The important treatment is the surgical evacuation of the pus with proper drainage. The operation is a simple, short one, and is best done under local anesthesia; these little patients do not take a general anesthetic well. Better drainage will follow removal of a short piece of rib, which should be done at the lowest level of the pus in the posterior axillary line; usually this is the seventh space on the right, and the eighth on the left side. It is best not to try to evacuate much pus, simply allowing it to slowly drain away. Simple incision without resection is often sufficient, particularly if the child is in bad condition and a short operation is demanded.

After recovery is advanced measures must be taken to expand the lung and break up the pleural adhesions. The coughing may do this; if it does not, the lung will be found by physical examination to be still collapsed. Blowing bubbles, or blowing a colored fluid from one bottle to another placed on a higher level, is very efficient; it serves as a toy for the child and it is usually easy to get him to use it. Extensive operation with rib resection may be necessary to allow movement of the lung sufficient for effective breathing.

CHAPTER XII.

DISEASES OF THE GENITO-URINARY SYSTEM.

ENURESIS.

Definition.—By this is meant an involuntary emptying of the bladder, resulting in wetting the clothes in the daytime or the bed at night.

Etiology.—During infancy lack of control is normal and voluntary urination is a matter of discipline and habit. With many children the lack persists for no definite reason, they being perfectly normal otherwise. The functional causes are many, but all act by producing very slight inhibitory control of the reflex centres of the brain or increasing the reflex action of the centres in the spinal cord. Malnutrition, anemia, adenoids, any functional neurosis, may seem to be the cause. Irritation of the genital tract, as phimosis, balanitis, vulvitis; of the anus or rectum; of the bladder, from calculus, pyelocystitis, etc., may be present. Probably the commonest ascertainable cause is an irritating, usually highly acid urine. Children with a neurotic tendency are most subject to it, but it is a very common condition and affects all sorts. Commonly a child should be taught to control urination during the second year.

Organic causes are malformations of the bladder, disease of the brain or cord, or of the kidneys. These are not considered here.

Symptoms.—In functional enuresis the lack of control is the only symptom. Most commonly this is manifest only at night; the urine may be passed several times during the night, less often only once. Often it occurs every night; or it may be irregular. It is usually much more noticeable in cool weather, the child perhaps being free from it in hot weather. The tendency usually lasts for some years, often until puberty, when it is overcome in nearly every case.

Prognosis.—It is usually a very stubborn condition, and often is quite resistant to any measure for its relief. Cases due to some abnormality, as phimosis, adenoids, etc., are comparatively very few, and but little can be expected from correction of such trouble. Treatment of any sort is not effective in probably the majority of instances.

Treatment.—Any possible cause of heightened reflex irritability must be searched for and corrected if found. The urine should be first examined for concentration, reaction, and evidences of bladder irritation or inflammation. The possibility of diabetes should always be had in mind and the urine examined for sugar; if permanent glycosuria is found, treatment for diabetes must be instituted.

For highly acid urine large doses of potassium acetate should be given with considerable water. If the urine is not concentrated, the amount of liquid is restricted, particularly after four in the afternoon. The child should live a simple life, free from excitement. The diet must be very simple and at regular hours. The child should urinate before going to bed and taken up once or more during the night. Punishment is unwise; reward for improvement is much more effectual. During the day he should be taught to hold the urine as long as possible. Certain mechanical measures are sometimes helpful, oftener not. Sleeping in a warm room, with warm covering, on a firm mattress is usually best. (It is true that sometimes just the opposite measures produce better results.) The foot of the bed may be raised six to eight inches. Instrumental measures are very disappointing, such as distention of the bladder, or the passage of sounds.

Drugs also are disappointing. The most valuable is belladonna, given in ascending dose until the physiological limit is reached. It is best given at 4 and 8 P.M., and must be continued for months, even after the enuresis ceases. A small percentage of cases are helped by strychnine. Rarely the condition stops at once when a very bitter dose is given before meals and at bedtime.

Despite all treatment many cases persist until puberty. But prolonged care, training, diet and fresh air will nearly always materially assist.

PHIMOSIS.

Definition.—The opening in the prepuce is so small that the glans cannot be exposed; always the prepuce becomes strongly adherent to the glans. At times there is such a small opening that it is difficult for the urine to pass through.

Symptoms.—Unless there is difficulty in passing the urine, there are usually no symptoms. Occasionally it produces irritation which results in reflex symptoms of various sorts. Enuresis, restlessness and irritability, priapism, masturbation, rarely general convulsions, or other severe nervous condition may be induced in a susceptible child.

Treatment.—Forcible retraction, breaking of adhesions and removal of the masses of smegma, are all that is necessary unless the prepuce is very long. The parts are anointed with vaseline and the retraction repeated often. If the foreskin is very long, circumcision is needed. It is to be remembered that the great majority of cases need no attention.

BALANITIS.

Definition.—This is an inflammation of the mucous membrane of the glans and prepuce.

Etiology.—Uncleanliness associated with adherent prepuce, masturbation, decomposing smegma, injury, and acute urethritis are the most common causes.

Symptoms.—The prepuce is swollen, red and tender, with slight or very profuse purulent secretion. The most severe cases are due to gonorrheal urethritis; the prepuce may be immensely swollen and urination be very painful.

Treatment.—Careful cleansing is usually all that is needful. This may be aided by the use of ice or cold packs, and the application of lead water. It may be necessary to slit the prepuce, break up the adhesions, and permit free drainage.

VULVOVAGINITIS.

Definition.—This is an inflammation of the female genitals similar to the above. It is much more common.

Etiology.—There are two varieties, the simple and gonorrheal. The first is due to the same things as balanitis in general; it is most likely to occur in children not in good general condition, during or after severe illness. The other is due to infection with the gonococcus, usually through contaminated towels, diapers, or fingers.

Symptoms.—These differ in the two forms only in degree. There is first a slight watery discharge, in the simple form, with slight evidence of inflammation, discomfort, itching and burning on urination. This may be all, but in severe cases all symptoms are pronounced and the parts may be bathed with an irritating pus.

The gonorrheal form is much more common than was formerly considered. It is quite contagious in institutions, and probably elsewhere, in spite of great care. There may be all degrees of discomfort, pain, discharge, and evidence of inflammation. Nearly always the vagina is affected to its vault, the uterus frequently, and the urethra seldom. A positive diagnosis is made only with the microscope, and this should be attempted in every case.

Treatment.—The simple cases improve under cleanliness, soothing solutions, and attention to the general health. The gonorrheal variety is extremely obstinate, needs careful, prolonged attention, and is very subject to recurrences. Children with this form should wear napkins to prevent other infection.

Douches twice a day with 1 to 10,000 potassium permanganate, followed with the application of silver nitrate in 1 per cent. solution, is the best routine method. The silver can be gradually increased to 5 per cent. It should be used only once a day, or even every other day, as indicated. The most scrupulous cleanliness of the parts should be observed.

HYDROCELE.

Definition.—This is an accumulation of serous fluid in the pouch which contains the testicle. It may be next to the testicle or in the inguinal canal. Four forms occur, all different anatomically but the same otherwise.

Symptoms.—There is a noticeable tumor, usually in the scrotum and not rarely on both sides. It fluctuates, and by transmitted light is translucent. Pressure does not reduce it, but may press it into the inguinal canal. It does not increase on standing, coughing, etc., as a rupture does, and it is a constant tumor.

Treatment. Usually they are best let alone. The condition does not harm and tends to disappear. If it persists for months, and shows signs of increasing, surgical intervention is called for. Simple aspiration may be sufficient.

PYELOCYSTITIS. PYELITIS.

Definition.—Cystitis is an inflammation of the lining membrane of the bladder; pyelitis of the pelvis of the kidney. They often exist together, but either kidney or bladder may be separately affected.

Etiology.—Pyelitis is oftenest caused by infection following renal calculus. It sometimes complicates the acute infectious fevers, scarlet, typhoid, etc. Sometimes it occurs primarily, or from a previous infection of the bladder. This is commonest in young children, and most often in girls.

Cystitis occurs following pyelitis at times. By far the commonest cause is infection through the urethra, and this occurs practically only in girls; it is commonest in infancy, and much more rare after four years. The colon bacillus is the usual cause.

Symptoms.—In an acute attack there is a sudden rise of fever that is usually impossible to explain, as the child may not seem to be ill. Sometimes there is a chill with the rising temperature. Generally the fever goes to 104° or 105° F. It is subject to wide variations, often dropping to normal and soon rising again as high as before. This may be the case for several successive days. In simple pyelitis there are often no other symptoms other than those due to any high fever. If there is also a cystitis, there are usually frequent, perhaps painful urination and tenesmus. If the condition complicates other diseases, it may show no new symptoms other than the pyuria, though the temperature nearly always increases or

persists in a manner otherwise unexplained. In chronic cases there are often no symptoms, but if prolonged, there is always a bad effect on the general health.

Without treatment the infection persists for weeks and there is danger of nephritis or pyonephrosis (distention of the pelvis and calices with pus). In the latter the symptoms are those of a violent infection, with pain in the back, rapidly progressing exhaustion, anemia, hectic fever, and sweating. Recurrences are frequent, in treated and untreated cases.

Diagnosis.– The diagnosis depends on the examination of the urine. This is strongly acid unless a chronic cystitis causes it to be alkaline; in children this is very rare. The amount of pus is nearly always enough to render the urine turbid. Rarely there may be only a very few cells, discovered only by the microscope; this is not apt to be the case on repeated examinations. Careful search will nearly always show epithelium from the kidney pelvis if there is a pyelitis. The diagnosis will often be missed unless there is a routine examination of the urine in every case of obscure fever. With such an examination it will readily be made. And it should be remembered that the condition is vastly more frequent in girls.

Treatment.—Calculi must be removed if the disease is due to them. The child should be kept in bed on a very plain diet. Water should be given freely. Often no medication is necessary except to render the urine alkaline with large doses of acetate or citrate of potash. In infants 20 to 30 grains daily is enough. The value of hexamethylenamine is open to question; it requires an acid urine to be effective and consequently the alkalies cannot be given with it. Instances of severe tenesmus not rarely occur when it is used in sufficient dosage. It should be deferred until the alkalies are plainly not effective; the dose is 2 grains every three hours to an infant of a year, with plenty of water.

Pyelonephrosis may require surgical methods.

Chronic pyelitis or *pyelocystitis* is sometimes apparently very much benefited by the use of vaccines prepared from the urine, usually being growths of the colon bacillus. When the leukocytes are comparatively few, injections of nucleic acid, or sodium nucleinate, are said to be of value in increasing their number. This needs confirmation.

URINARY CALCULI.

Definition.—Deposits of the solid contents of the urine occur rather frequently, forming hard, crystalline masses in the tract which are called stones, or calculi.

Etiology.—In the great majority of cases they form in the calices or pelvis of the kidney; bladder stones nearly always are formed from small ones which pass down the ureter. Most of them are composed of uric acid, rarely phosphates or calcium oxalate. Stones large enough to give rise to symptoms are extremely rare in infancy, but the so-called "gravel" is very common and may give very severe colicky pain shortly after birth when too little water is given; severe crying spells in the first few days may be due to the passage of the small stones through the ureter.

Symptoms.—Large calculi may be found in the kidney or even in the pelvis at autopsy without having given any symptoms. Definite symptoms are rare in infants. In older children there are pain and tenderness in the kidney region, radiating to the bladder or perineum, sometimes to the penis or testicle. When a stone of large size enters and works down the ureter, there are the sharp, sickening pain, vomiting, collapse, etc., as seen in the adult. Urination is frequent and some blood nearly always present. Impaction causes hydro- or pyonephrosis; pyelitis is common.

In the bladder, stones are much less common. There is frequent, painful urination, straining and tenesmus; sometimes the flow of urine is started and suddenly stops. Prolapsus ani may result from straining. Incontinence of urine generally exists. Changes in the urine are not common nor marked, unless there is pyelitis; cystitis without pyelitis is uncommon from calculi.

Diagnosis.—A large stone can be felt by bimanual, rectal examination. Exploring with a sound is the most valuable means. The *x*-rays are of great value.

Treatment.—In kidney calculus the child should be put on a largely liquid diet and made to drink plenty of water. Sufficient alkali should be given to render the urine alkaline. With persistence of symptoms operation should be performed.

This is best done early, before any of the serious complications develop, as the results then are very good.

Treatment of vesical calculi is purely surgical.

With any sort of calculus the child should be given a bland diet for long after the operation, drink quantities of water, and the urine kept from becoming strongly acid for any length of time. This will tend to prevent the formation of stones.

POLYURIA.

(Diabetes Insipidus.)

The amount of urine passed by infants is proportionately very much larger than that of adults, due to the greater amount of liquid in the food. But there is a condition in which such very large amounts are passed as to be well called polyuria, or diabetes insipidus. It is exceedingly rare in children, and its course is essentially chronic. It has no definite cause, no known pathology, and is very obscure in every way.

Etiology.—Heredity is believed to be a strong factor. Severe injury to the head, brain tumor or other gross cerebral lesion seem to be the cause in some instances. Rarely it follows severe, acute infectious diseases. Abnormality of the pituitary gland is sometimes the cause.

Symptoms.—The passing of enormous quantities of urine, and the corresponding amount of fluid taken, are the prominent symptoms. There are usually marked nervous symptoms, insomnia, headache, heart neuroses, and hysteria. Usually there is progressive weakness, anemia and malnutrition, but the progress is very slow and often there is no sign of ill health. The urine is almost colorless, the specific gravity 1.001 to 1.005, without other abnormality.

Prognosis.—Children rarely die of the disease, and it therefore continues into adult life. It has no tendency to cause death of itself, but leaves the patient open to a poor prognosis from other diseases. A few cases recover spontaneously and some are markedly benefited or even cured by treatment.

Treatment.—Fluids should be restricted as much as can be without suffering. Simple, nutritious diet, moderate exercise, and care to prevent any acute disease, are the most important measures. Drugs are of little benefit in most cases. Small doses of codeine long continued; ergot, belladonna and the bromides; all have seemed to produce some effect in some cases. Some are benefited by the use of pituitary extract.

ORTHOSTATIC ALBUMINURIA.

Definition.—Certain children have a noticeable amount of albumin in the urine after exercise, and none at all after a long period of rest. It has been found that the amount of albumin is increased if the child is made to assume the position of lordosis, *i. e.*, forward curving of the lumbar spine; it has therefore also been called lordotic albuminuria.

Etiology.—Very many children who are otherwise perfectly normal may frequently have a small amount of albumin in the urine after considerable exertion or prolonged lordosis. But lordotic albuminuria is applied only to those who show it constantly after exercise or lordosis, who have many symptoms of a neurotic temperament, are often poorly nourished, and sometimes in poor health for no reason that can be discovered.

It is much more common in boys than girls and in those from eight to sixteen years. The direct cause seems to be vascular pressure in the kidneys from some obscure cause, due to the upright or lordotic position.

Pathology.—There is none. Functional tests show that the kidneys excrete perfectly normally during perfect rest, but are not as efficient during active exercise or in the position of lordosis.

Symptoms.—These children are considerably affected by strain or excitement, apt to be anemic and poorly nourished, have frequent headaches, are hysterical or have a marked nervous instability. They often have cold hands and feet, palpitation of the heart, fainting spells, etc.

The examination of the urine shows the condition. This must be done repeatedly at frequent intervals. After a

night's rest the urine is normal. After being on the feet a number of hours the urine contains albumin. If now the child is made to lie on the back with an object so placed in the lumbar curvature as to give a very decided lordosis, the urine, after ten minutes of this position, will show considerable albumin; there may be so much as to solidify the urine when it is heated. The same result may be obtained by standing against the wall with a stick thrust between the elbows behind the back. The urine contains no other abnormality, except perhaps an occasional hyaline cast or trace of sugar; both are very rare.

Diagnosis.—Nephritis must be excluded by frequent examination for casts and blood cells. It can hardly be confounded with anything else.

Prognosis.—This is very good, as the albuminuria seems to have no serious effect on the general health.

Treatment.—This consists entirely in improving the child's general health by any means that seem indicated. Anemia should be discovered and treated with iron and the proper diet and hygiene.

ACUTE RENAL DEGENERATION.

Definition.—It is often impossible to draw the line sharply between actual acute nephritis and the so-called "febrile albuminuria." The term acute degeneration is applied to the cases in which there are no constitutional symptoms of nephritis; in fact, no constitutional symptoms due to the kidney lesion.

Etiology.—It occurs with very great frequency in the infectious fevers, particularly diphtheria, pneumonia and scarlet fever, or in any case with prolonged high fever. It may occur from irritating drugs.

Pathology.—The epithelium shows cloudy swelling throughout both kidneys. The kidney is slightly enlarged, soft and pallid. There is no inflammatory infiltration, but there may be some congestion.

Symptoms.—There are no symptoms other than those of the original disease. There is no increase in severity that can

be attributed to the kidneys; probably the progress of the disease is influenced by this complication to a certain extent. The urine contains a considerable trace of albumin, is highly colored and concentrated, and may show a few hyaline, less often granular and epithelial casts.

Prognosis.—The kidney returns to normal if the original disease is recovered from. The danger of acute nephritis is probably increased by the existence of such degeneration.

Treatment.—There is none. Especial care with the diet, plenty of water and frequent catharsis, should be the measures taken in anticipation of possible nephritis.

ACUTE NEPHRITIS.

Definition.—Attempts to divide acute inflammations of the kidneys into groups such as acute interstitial, acute exudative, parenchymatous, etc., serve only to confuse. Acute interstitial nephritis probably does not exist except as abscess formation. The others are simply varying degrees of inflammation of both the epithelial and connective tissue.

Etiology.—Acute nephritis is always an inflammatory condition. It occurs as a primary inflammation, due to exposure, cold, excessive exertion, etc., and the cause then usually is not known. By far the greatest number of cases occur following scarlet fever; less often diphtheria, influenza, and any other infection, even (very rarely) chicken-pox. It occurs in about 5 per cent. of cases of scarlet fever, and as often after the mild as the severe.

Pathology.—Naturally the cases examined postmortem have been the severe ones. But any degree of inflammation may exist. The kidneys are large, soft and paler than normal. The cortex is thickened, the epithelium showing all degrees of cloudy swelling, fatty degeneration, and necrosis. The interstitial tissue is infiltrated with leukocytes and serum. Few or many minute hemorrhages are apparent. The glomerular lining is swollen and the capsular spaces contain the products of inflammation. According as one or the other of these items greatly predominates the cases have been

called parenchymatous, glomerular, hemorrhagic, exudative, etc., nephritis. If the interstitial tissue is severely affected, the change is probably permanent and the case may properly become one of chronic interstitial nephritis.

Symptoms.—In the primary form, which is comparatively rare, the disease begins rather abruptly with high fever, vomiting, marked nervous symptoms and often severe backache. There is very often diarrhea. The urine is much decreased in quantity. At first the amount of albumin may be small, but soon it is present in large amount, with hyaline and granular casts, many white blood cells, and fewer red cells and renal cells. As the disease progresses the nervous symptoms become more marked with dulness, stupor and perhaps severe headache. Anemia develops early; nosebleed is common. Dropsy is not very common in the acquired form. All the symptoms are apt to be more severe in infants and the outcome is very much worse. It lasts from two to six weeks. Mild cases may clear up without any severe symptoms.

The secondary form comes on insidiously in most cases, and usually during the acute condition to which it is secondary. The symptoms are not marked; in most cases the diagnosis will not be made unless the urine is examined because the child is not doing very well, or examined as a routine measure. Dropsy does not occur often until late. The amount of urine is scanty, but may be passed frequently. There is apt to be headache, nosebleed, restlessness, and increased temperature.

The characteristic type which occurs so often after scarlet fever, and is often called glomerulonephritis, most often develops in the third or fourth week, but may develop after several months. Dropsy is very common, being first noticed as a puffiness of the eyes and face, next in the feet and legs, hands, and in the male, the scrotum. It may be a general anasarca, with fluid in the pleural and peritoneal cavities. This may be the first symptom of nephritis. With it, or following very shortly, there is often a peculiar waxy pallor of the skin that is quite characteristic; this usually occurs at some time in every severe case. The symptoms may be

more abrupt, with fever, headache, vomiting, scant reddish-brown urine. And the ordinary dropsical form may occur in cases not due to scarlet fever, though much less often.

The urine is apt to be dark from the presence of blood, contains a large amount of albumin, many granular and hyaline casts, leukocytes, and renal epithelium.

In very severe cases the onset may be startlingly abrupt, with high fever, backache, extreme restlessness, and very scanty or suppressed urine. Uncontrollable vomiting soon begins, the child tosses about the bed, perhaps becomes delirious, and suddenly develops general convulsions; or subsides into a uremic coma.

Diagnosis.—Efforts to determine what tissue of the kidney is principally affected, parenchyma, glomeruli or supporting tissue, are futile and have no bearing on the treatment. Cases with dropsy usually are easy to interpet. Cases without it will not be discovered unless the urine is examined. The combination of fever, vomiting, great restlessness with twitching muscles, anemia, scanty urine, and, in older children, headache, should be enough to suggest nephritis. Complicating disease of the heart or lungs should be constantly looked for in every case of nephritis. Death nearly always results from such developments, or from uremia.

Prognosis.—Death does not often occur from acute nephritis except in infants. The greater danger is in the permanent damage to the kidneys resulting in chronic nephritis. Cases usually survive the acute stage if uremia does not develop, and if there are no serious complications; this includes a very large majority of all cases. It is certain that many cases present symptoms of chronic nephritis long after they were considered entirely well.

Treatment.—Most important is the prevention of nephritis, if possible, by largely decreasing the work of the kidneys when the likelihood of its development exists. This is apt to be thought of only in scarlet fever, and to a less extent in diphtheria and influenza. Daily warm baths, the use of moderate hydrogogue cathartics enough to secure two fluid actions every day, and giving large amounts of water and other fluids, are the measures of safety. The diet should

consist of milk, starchy food, cooked fruit and perhaps small amounts of orange-juice and lemonade. Milk in various forms should be the greater part of it. In scarlet fever this is continued for a week after the temperature is normal, and longer if there is albumin in the urine.

When nephritis exists, or there is any albumin in the urine, the above measures should be rigidly adhered to; if the case is a severe one, a rigid milk diet is advisable. In moderate cases the above measures, with complete rest, will result in recovery.

Severe cases require free sweating two or more times a day by means of hot packs of any convenient kind; these should last from twenty minutes to an hour, according to the ability to stand them. Mustard paste applied over the kidney region, to produce active counter-irritation, is valuable. Daily doses of magnesium sulphate, or other laxative, should be given. Slow rectal injection of normal salt solution, a quart or more a day; injections under the skin of one-half pint twice a day or oftener; even the withdrawal of from two to eight ounces of blood, according to the age and strength of the child, all have a decided value. The nervousness is best relieved by chloral and bromide, best given by rectum because of the likelihood of inducing vomiting; if it is very extreme and symptoms of impending uremia occur, it is well to use one or two doses of morphin. Uremia and suppression of urine are treated, aside from the above measures, with nitroglycerin or veratrum, used hypodermically. Veratrum should be used every two hours, nitroglycerin every hour for six to eight hours, unless the effect is procured sooner. Softening of the pulse, and subsidence of the violent symptoms, are the results to be looked for. It is in this condition that venesection is particularly indicated; it is well to inject twice as much salt solution as the amount of blood withdrawn.

After the acute symptoms have subsided the urine must be watched for months. The diet should be restricted, skin and bowels kept active, and usually it is necessary to give iron for the anemia.

CHRONIC NEPHRITIS.

Chronic inflammation of the kidneys is comparatively rarely seen in children. It is certain that many cases are overlooked because of failure to examine the urine, and the child does not develop active symptoms until much later in life.

Etiology.—In the great majority of cases it is a result of an attack of acute nephritis. The only other factors in childhood are chronic heart disease and syphilis, less often prolonged tuberculosis. It is very rare under six years.

Pathology.—As in the adult there are two distinct varieties, parenchymatous and interstitial.

In the parenchymatous type the kidney is usually of the "large white" variety, not the "small white" kidney. There is a condition known as the "large red" kidney, due to many small hemorrhages, that is not infrequent. There are all degrees between one and the other. The epithelium is granular, shows fatty degeneration, and necrosis. The marking is irregular. The tubules contain the material that forms the casts; red and white cells, epithelium, and the albumin that holds them as casts. Always there is interstitial change, proliferation of the cells and edema. This proliferation is striking in the Malpighian bodies, together with nuclear proliferation and distention of the capsule with detritus.

The interstitial variety may result from the above, or the principal changes be interstitial from the start. The kidney is small, granular, and dark in color; the capsule is firmly adherent. The cortex is thin and irregular; the glomeruli small, many of them destroyed or surrounded by thick bands. Everywhere there is a marked increase in connective tissue. There are many retention cysts from obstruction of the tubules; many of the tubules have been completely destroyed.

Symptoms.—These are always slow and insidious in development. By far the most common form is the parenchymatous. Dropsy and anemia are usually the first signs. Loss of appetite, vomiting, attacks of indigestion with

diarrhea, and frequently nosebleed, are common symptoms. Attacks of nervousness, frequent headaches, dyspnea after exertion, and unusual fatigue, usually develop. The anemia before long produces the peculiar pallor known as waxy. And there is steady loss of weight unless the dropsy is pronounced.

The urine always contains albumin, casts, and cellular elements. Usually there are times when all these are present in large amount, and later much decreased for perhaps a long time; this gives a false idea of the progress of the disease. The daily amount is usually less than normal, and always is much less during the time when the urine is strikingly pathological. The progress is slow, often five or ten years, with the patient slowly losing ground. Death occurs, as in the acute form, in uremia or from some complication in the heart or lungs.

The interstitial form is so rare in children and the course so chronic that death rarely occurs under fourteen years. Symptoms are few. There is a greatly increased amount of urine, pale, of low specific gravity, and containing little or no albumin and few casts or cells. Dropsy often is not present, and is never extreme. Nervous symptoms ultimately develop. The blood-pressure is high and the left ventricle of the heart hypertrophied. Death usually results from uremia.

Prognosis.—This is very poor; probably no case of chronic nephritis completely recovers, and the child dies eventually from the disease or one of its frequent complications. Many years may be spent in comparative comfort.

Diagnosis.—Diagnosis depends on examining the urine as a routine measure. If this is not done, chronic nephritis will be missed in the great majority of cases, and the obscure symptoms attributed to something else.

Treatment.—The child should live in a warm, dry climate if possible. Special attention should be paid to warm clothing when needed, and to prevent exposure to marked changes in temperature. Exercise should be regular and moderate, with several hours of rest each day. The diet should consist largely of milk, carbohydrates, fruits and fresh vegetables.

The bowels should be kept freely opened. The prolonged use of iron is often needed and the effects very beneficial. If dropsy is present, daily warm baths to produce free sweating, cathartics, diuretics and stimulants, are used as in the acute form. It may be necessary to tap the serous cavities for the removal of fluid. When uremia develops nitroglycerin or veratrum, or both, are indicated; venesection with intravenous saline injection should be done. Morphin and chloroform are both valuable to control the convulsions.

The operation of decapsulation of the kidney has been many times performed and good results reported. The results are never permanent and the procedure is not to be regarded as a possible cure. Subsidence of symptoms may be obtained for many months.

TUBERCULOSIS OF THE KIDNEY.

This is quite rare in children, except as part of a general tuberculosis. It is of importance particularly because of the obscurity of the symptoms and the difficulty in diagnosis. The symptoms are those of vesical irritation; frequent urination, particularly nocturnal, and pain and tenesmus. The kidney is enlarged and usually low enough to be easily felt; it is often slightly tender. The characteristic sign is the presence of blood in the urine. The amount is small, discovered only by the microscope or chemical tests, but it is present at some time of the day or night in every case, and comparatively early. Pus cells are always present but not in great numbers. Inoculation of a guinea-pig will always show the presence of the bacilli in the sediment.

The process is confined to the kidney in nearly every case; the tendency to bladder involvement that is so frequent in adults is slight in children.

Prognosis.—The prognosis is distinctly bad, the process usually going on to destruction of the kidney. Tuberculosis of some other part of the body usually exists.

Treatment.—Medical treatment is that of tuberculosis elsewhere. Early operation certainly gives the best result, if the other kidney is healthy, and a long trial of dietetic

and medical treatment is likely to make the removal of the kidney more difficult and find the child in poorer condition to withstand it.

PERINEPHRITIS.

Definition.—Strictly speaking, this is an inflammation of the fibrous capsule immediately surrounding the kidney. In general it is used to designate any acute inflammation of this capsule, or of the fatty capsule, or of the retroperitoneal fat. As one tissue is nearly always affected from the other and all may be inflamed at the same time, by extension, they are grouped together under the above term.

Etiology.—It may be secondary to suppuration of the kidney or may be primary. Traumatism gives rise to a number of cases; the other primary ones occur without ascertainable cause; cold, exposure and exhaustion seem to have some influence. The commoner organisms are the staphylo- and streptococcus, pneumococcus, colon bacillus; rarely others.

Pathology.—The great majority of the cases begin in the fatty capsule. There is marked infiltration with pus cells and serous exudation, nearly always extending into the retroperitoneal tissue.

Resolution may take place during this stage and the parts return to normal except for the formation of a certain amount of fibrous tissue. Or destruction of the tissue may occur with the formation of one or more abscess cavities. The pus burrows extensively; it may go downward between the abdominal muscles and point at the lower portion of the abdomen; the most common path is between the lumbar muscles, pointing above the crest of the ilium posteriorly.

Symptoms.—The onset is usually rather abrupt in the primary cases, which is much the more common form in children. There is a sudden rise of temperature, perhaps a chill, and localized pain in one side in the lumbar region. The fever is irregular but constant. The child resists and cries with pain at any movement or attempt at manipulation, and, if lying, keeps the leg drawn up and cries at attempts to straighten it; if walking about, there is a decided limp which

increases as the disease progresses. Tenderness and rigidity soon become localized over the kidney. Quite characteristic is the frequent curving of the spine away from the affected side; this is due to an effort to relieve the muscular strain, and the thigh then is usually strongly flexed. For this reason it is frequently mistaken for hip disease. As the disease progresses there is nearly always an infiltration of the subcutaneous tissue above the ilium posteriorly; this develops into a distinct tumor and later presents a point of suppuration which may burst. This may occur at the upper portion of the thigh, and be mistaken for a psoas abscess. The symptoms may slowly subside and resolution take place, with recovery; this does not occur after the formation of any considerable amount of pus. The leukocyte count is invariably high.

Not rarely the onset may be gradual, always with some fever, and the limp may be the first thing noticed. It may be two weeks before very decided symptoms appear.

The duration of the process is from two to six weeks in the acute cases; in the subacute it may be two or three months.

Diagnosis.—The conditions likely to be thought of are, most often, hip disease, and rarely Pott's disease. Tuberculous hip disease is much more chronic, the pain and fever are much less, and the leukocyte count is not high; this applies also to Pott's disease. The *x*-rays will differentiate. Calculus and pyelitis have very different symptoms and show urinary changes. Perinephritis may follow either, or it may be the cause of pyelitis.

Prognosis.—Children practically always recover from uncomplicated perinephritis.

Treatment.—The child should be kept as quiet as possible, the bowels well cleared, and the diet restricted during the acute stage, if there is one. Heat or cold is applied to the side, as it is most comforting. Any necessary measures should be used to keep the patient in comfort. When suppuration is definite incision and drainage should not be delayed. Recovery is then usually prompt.

NEW GROWTHS OF THE KIDNEY.

Benign tumors are rare in childhood, but malignant ones are fairly frequent. They are nearly always primary. In the great majority of cases the growth is a sarcoma. It may develop from the kidney or pelvis, rarely from the latter. It sometimes reaches tremendous size, causing pressure on the ureters with hydronephrosis, or on the vena cava, causing thrombosis and dropsy. Adhesions form to other organs, and there are frequent metastases. The tumor is soft, bleeds easily, but is rarely cystic.

Symptoms. The important symptoms are the tumor, blood in the urine and the cachexia. The tumor is first noticed in the kidney region but often the parents have noticed the prominence in the abdomen before anything else has attracted attention. Its surface is often irregular, but may be quite smooth; it is not very firm. It grows with great rapidity, so fast as to make one doubt that it can be a solid tumor. Weakness and anemia are not very marked until the growth is easily palpable anteriorly. Hematuria is quite constant but often noticeable only through microscopic examination. Pain and pressure symptoms are rare.

There is nothing that is likely to be mistaken for it except a very large spleen; there are usually other diagnostic points to account for the large spleen. Hydronephrosis is a fluctuating tumor.

Prognosis.—This is absolutely bad. These children die usually within a year after the tumor has appeared.

Treatment. Recovery is possible if the tumor is removed very early. Otherwise death is certain.

CHAPTER XIII.

DISEASES OF THE NERVOUS SYSTEM.

DISEASES OF THE SPINAL CORD AND PERIPHERAL NERVES.

PERIPHERAL NEURITIS.

Definition.—Peripheral or multiple neuritis is a degeneration of the parenchyma of the nerves, resulting in more or less loss of function of the part involved.

Etiology.—In children the great majority of cases are due to acute infections, and most of them follow diphtheria. Typhoid, malaria, influenza and scarlet fever, rarely others, may be the cause. Prolonged use of arsenic in large doses occasionally produces it; lead and alcohol, which are frequent causes in adults, rarely cause it in children. Occasionally exposure to cold seems the only factor.

Pathology.—The inflammatory changes are confined to the interstitial, not the nerve tissue. This shows only degenerative changes, in severe cases the myelin being destroyed in considerable amount. On this account multiple neuritis has been called parenchymatous neuritis.

Symptoms.—The symptoms develop gradually and complete paralysis may not result for several weeks. Rarely there is sudden onset with considerable fever, pain, and sudden paralysis. More often there is pain and tenderness along the affected nerves, tingling and burning, with often a sense of numbness. Soon a general weakness is noticed in the parts supplied, and this progresses to more or less complete paralysis. There is often hyperesthesia of the affected parts for a few days, followed by partial anesthesia. Always the reflexes are lost or markedly diminished. Atrophy is constant in moderate

cases, and may be extreme in severe ones. The normal electrical reactions are changed and eventually the reaction of degeneration appears.

Peripheral neuritis is always bilateral and symmetrical. Except when it follows diphtheria, it is most common in the arms and legs. Invariably the distal parts are more affected than the proximal, producing the wrist-drop and foot-drop. It may involve all four extremities and the trunk and neck. The feet and legs are affected oftener than the arms.

In diphtheria the characteristic paralysis is of the cranial nerves and those of the heart and respiratory muscles; paralysis of the legs is frequent. Most often the palate is affected, causing food to be returned through the nose. Next commonly the muscles of the eyes, causing squint and sometimes paralysis of accommodation. Death may result from paralysis of the heart and respiratory muscles.

The disease progresses slowly and recovers slowly, lasting from one to four months. Recovery is the rule unless the heart and lungs are affected.

Diagnosis.— This is sometimes extremely difficult, particularly from acute poliomyelitis. Peripheral neuritis is always bilateral, affects both feet or both arms, has sensory symptoms, and develops gradually; in the acute cases the final course and the permanence of sensory symptoms are most important. When all limbs are affected, or the palate, throat or eye muscles, the disease is nearly always multiple neuritis. Cerebral palsies and Pott's paraplegia show increased reflexes and slight atrophy, with no nerve degeneration.

Treatment.— In the acute stage pain is often severe. This is best relieved by dry heat. If this is not effective, phenacetin, or even opium may be necessary. After diphtheria great care should be taken to prevent exertion for a week or two, as death may result from exercise. At the end of three or four weeks the acute process will have entirely subsided, and electrical stimulation should be begun. Full doses of strychnin are of some value. Massage, passive motion, and general tonics are helpful measures. Feeding with a stomach-tube may be necessary in diphtheritic palsies.

In respiratory failure full hypodermic doses of strychnin and electrical stimulation of the thoracic muscles and diaphragm will sometimes induce respiration. In threatened heart failure strychnin, combined with effective doses of morphin, does better service than anything. Both conditions are extremely serious and the mortality is high.

TRANSVERSE MYELITIS.

Various forms of general or local myelitis are seen occasionally in children. The only one that occurs frequently enough to be given separate consideration is that involving a certain cross-section of the cord, and called transverse or compression myelitis.

Etiology.—By far the commonest cause is pressure from bone destruction in tuberculosis of the spine; it is therefore often called Pott's paraplegia. Fracture or dislocation of the spine, or hemorrhage in the canal, may cause it.

Pathology.—Most cases occur in the cervical or upper dorsal region, less often in the lumbar and lower dorsal. In cases where the symptoms develop suddenly there is a sudden displacement of a portion of carious bone which usually presses on the front of the cord. Cases of gradual onset (the majority) show some displacement of bone from the anterior curvature, but also tuberculous inflammation and thickening of the periosteum and dura mater; this increases until it encroaches on the cord. In cases of gradual onset or of long standing there is more or less interstitial inflammation of the cord elements with destruction of the cells. With considerable destruction there is accompanying ascending or descending degeneration of the nerve fibers. The nerve roots in the neighborhood also share in the inflammation.

Symptoms.—Usually the onset is gradual, and the first symptoms may not be referred to the spine at all; there may be sharp, lancinating pains in the neck, shoulders and chest, upper abdomen, or groin, and they are generally supposed to indicate some trouble in the part in which the pain is felt. These symptoms are due to irritation of the anterior nerve

roots. Soon there is a gradual weakening of the legs; if the lesion is high, the arms also are affected. Movements are apt to be awkward and inaccurate.

With this condition there is partial loss of sensibility and often tingling, numbness, and rarely pain, in the legs or legs and arms. Paralysis often becomes complete, with marked anesthesia. Rarely the lumbar enlargement is involved; then there is complete paralysis of the legs, anesthesia, and incontinence of urine and feces.

Ordinarily the reflexes are strikingly exaggerated, knee-jerk, ankle-clonus, Babinski, etc., with marked spasticity and rigidity. If the compression is very high, there will be vomiting, irregular dilatation or contraction of the pupils, perhaps hiccough from phrenic irritation, or even paralysis of the diaphragm. Atrophy and secondary contractures occur in severe cases, but never as marked as in poliomyelitis.

Rigidity of the spine from spasm of the muscles is a valuable sign of Pott's disease and must be borne in mind, though not particularly a sign of compression of the cord.

Diagnosis.—After the onset of paralysis this is usually easy. The increased reflexes, spasticity, and sensory changes are typical. Lumbar lesions are more difficult to interpret. Kyphosis makes the diagnosis, but it is often not present for some time after the symptoms appear.

Prognosis.—With early diagnosis and proper treatment most cases will recover perfectly, as far as the paralysis is concerned. Tuberculosis elsewhere may prove fatal. Other diseases are apt to hasten a fatal termination. In lumbar compression, acute cystitis and bed-sores are to be feared. Relapses are not infrequent.

Treatment.—This is largely orthopedic, reducing the deformity and relieving the pressure on the spine. Diet, fresh air, and scrupulous cleanliness of the body are necessary. Gibney recommends the use of potassium iodide in large doses over a period of many months. The indication for bone-splints is the same as that in Pott's disease in general, but their use is most successful in acute cases.

FRIEDREICH'S ATAXIA.

Definition.—This is a chronic disease of the cord characterized by extreme ataxia, and so definitely occurring in certain families that it is called hereditary ataxia.

Etiology.—Nothing is certain about this except the feature of heredity. There is often some other hereditary taint, as insanity, epilepsy, lues, alcoholism, etc. Often more than one child in the family is affected.

Pathology.—Atrophy of the cord elements is the essential lesion, unaccompanied with inflammation of any sort. The posterior columns are chiefly affected; the direct cerebellar, the direct and crossed pyramidal tracts to a less extent. The nuclei of the affected tracts show a corresponding atrophy. Other tracts may be affected, and cases have been reported in which the cerebellum was smaller than normal. The cerebrum is not affected.

Symptoms.—The symptoms begin usually between four and ten years. A hesitating, awkward walk is first noticed. The legs are far apart and the walk strikingly like that of intoxication. The child falls easily. The body sways in standing with the feet together; this is not increased by closing the eyes. Incoördination and ataxia soon are noticeable in the arms and hands. Typical at this time is the beginning lateral curvature of the spine; and the typical deformity of the foot may also be slightly evident; this is a marked extension of the foot, making the dorsum stand out prominently, and extension of the great toe—sometimes very like the equinovarus form of club-foot. Speech becomes slow, jerky, and hesitating. The face has a stupid expression but the intelligence is not markedly affected.

Impulsive, uncontrollable laughter is noticed in some cases. Lateral nystagmus occurs at some stages, usually rather late. Pain and sensory symptoms do not occur. The reflexes are usually lost early; rarely they may be increased. Babinski's sign is present.

When the disease is well developed, the ataxia is extreme, the arms and legs being practically of normal strength but every movement awkward and ineffective; walking is difficult

and the child staggers pitifully. It is difficult for him to feed himself or handle objects in the attempt to use or play with them. Sooner or later the child becomes bed-ridden and is almost entirely helpless. Life may be prolonged for many years.

Diagnosis. Locomotor ataxia, multiple sclerosis and cerebellar tumor present certain similarities, but the differences are many. History, ataxia without spasticity, lost reflexes with the positive Babinski, and the scoliosis and club-foot, are the typical features.

Prognosis.—This is absolutely bad as to recovery. Life may be prolonged for many hears.

Treatment.—There is none that has any effect on the disease.

PROGRESSIVE MUSCULAR ATROPHY.

The various muscular atrophies are rare conditions. At least one of them is recognized as being due to a spinal abnormality, and they are all best considered together, however closely related in pathology they may be.

The *Duchenne-Aran type*, also called *chronic anterior poliomyelitis*, is a progressive muscular wasting associated with degeneration of the cells of the anterior horn. The familial type of Werdnig and Hoffmann is more like amyotrophic lateral sclerosis, but its occurrence in the early months or years of life and the strong hereditary tendency have caused it to be considered as a spinal muscular atrophy of childhood. The Charcot-Marie-Tooth type, affecting first the feet and legs, is of unknown pathology.

The first form shows very slow wasting of the muscles of the ball of the thumb, later the palmar muscles and the interossei; this may produce a characteristic deformity, the "claw-hand." Still later the forearm is affected. The process may stop here, or may extend to the shoulder, neck and back.

Characteristic are the fibrillary contractions in the muscles before the atrophy begins in them. The faradic reaction decreases as atrophy progresses, and when atrophy is complete it is absent.

The disease does not shorten life unless the muscles of deglutition or respiration are affected. It is incurable.

The second form affects first the muscles of the pelvis and trunk, later the thighs, then the neck and arms. These children usually do not learn to walk, or can do so with difficulty; getting down on the floor, or getting up is difficult. The vital muscles may be affected early, and death usually results from paralysis of the respiratory muscles. The feet assume a position of equinus, due to paralysis of the anterior muscles. Electrical response is diminished or absent, the reaction of degeneration is present in the affected muscles at some time, and the fibrillary contractions occur before atrophy. The course is rather rapid and always ends fatally.

The third type is more rare than the preceding. It affects first the feet and legs, the hands and arms being affected perhaps years later. The fibrillary contractions and reaction of degeneration are present in the affected muscles. The characteristic is the involvement of the distal muscles of the limbs with nearly complete integrity of the proximal muscles. The disease does not shorten the life, but is incurable.

In none of these conditions is there any increase in tendon reflexes; they decrease, and are finally lost. There are no abnormal reflexes, as Babinski, ankle-clonus, etc. There is no pain, no change in cutaneous sensibility, and no mental involvement. The essential lesion is the atrophy of, and loss of function in, certain groups of muscles.

PROGRESSIVE MUSCULAR DYSTROPHY.

This presents such similarity on the part of the muscles to the foregoing that it is best considered at the same time. However, it is a disease of the muscles, not of the spinal cord. It is distinctly herditary, though several cases have been observed without the feature of heredity. It nearly always occurs in early childhood. The essential lesion is a slow destruction of the muscle fibers, resulting in marked weakness and wasting. The apparent hypertrophy of certain muscles that sometimes occurs (earning the name of "pseudo-hypertrophic" muscular palsy for the disease) is really a fatty degeneration of the muscle, proliferation of the nuclei, and hyperplastic proliferation of the connective tissue.

What have been described as different types are probably the same disease affecting different groups of muscles. The most frequent form begins with weakness of the legs from gradual atrophy of the thigh and pelvic muscles; with this is often associated enlargement of the muscles of the calves, or perhaps the back of the thighs and gluteal muscles. The weakness and enlargement may be noticeable before atrophy is apparent. Sometimes the shoulder and neck muscles are affected first. In any case the disease may progressively involve the muscles of all the limbs and the trunk. Rarely the muscles of the face are affected. In the pelvic type there is some lordosis, which may be extreme. In the shoulder type the condition of "winged scapulæ" and loose shoulders results. The walk is often extremely characteristic, and called the "duck walk" because of the alternate lifting of the hips. Another characteristic is the manner of rising from the floor; the child supports himself on hands and feet and then rises by "climbing up his legs" with his hands—the back muscles being too weak to raise the body.

The fibrillary tremor is never present, nor the reaction of degeneration. Reflexes are lessened and gradually lost when atrophy becomes complete. There are no sensory or mental symptoms. Muscular contractures very often occur, making it impossible to entirely straighten the limbs.

The course is exceedingly chronic, but not fatal except as it renders the victim less able to resist other serious disease. These children never are very bright, but cannot be said to be defective. Treatment is of no avail.

DISEASES OF THE BRAIN.

HYDROCEPHALUS.

Chronic internal hydrocephalus has been described briefly under Diseases of the Newborn. The condition in older children presents many differences, and the origin is often definitely known, which is not often the case in the congenital form.

Etiology.—It is always due to one of three abnormalities; either there is an obstruction of the aqueduct of Sylvius which normally allows the passage of the cerebrospinal fluid into the fourth ventricle; or the foramina leading from the fourth ventricle to the subarachnoid space are obstructed; or there is marked lessening of the power of absorption by the membranes, by which means normally the fluid enters the blood. In

FIG. 14.—Cross-section of normal and hydrocephalic brains of dogs. In the latter the Aqueduct of Sylvius has been artificially plugged to cause hydrocephalus. (Dandy and Blackfan.)

the congenital form the first is much the most common cause; in the acquired form the last is seen with greater comparative frequency, but obstruction is still the more common cause.

Acquired hydrocephalus, which will be considered in this chapter, is most often due to tuberculous and chronic posterior meningitis, less often other forms of meningitis, and to tumors

of the base of the brain. It sometimes develops after operations for encephalocele or myelocele.

Pathology. The lesions are those of the diseases to which it is secondary. Meningitis causes an exudation which

FIG. 15.—Cross-section of brain of normal infant. (Dandy and Blackfan.)

occludes the opening of the aqueduct of Sylvius, or the foramina of Magendie and Luschka, or so injures the brain and spinal meninges that absorption is seriously interfered with. Cysts or tumors of any sort cause hydrocephalus by pressure which obliterates the aqueduct.

Symptoms. In infants whose skulls are still capable of expansion, the symptoms are the same as described under the congenital form, except that the collection of fluid is never so extreme, in fact, is never more than a few ounces. In older

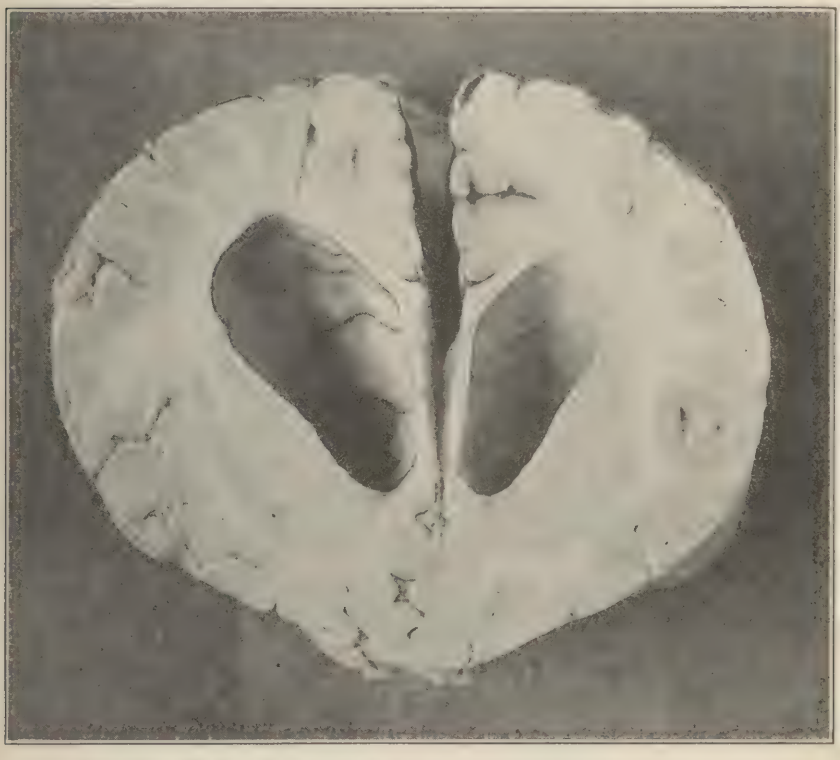


FIG. 16.—Cross-section of brain of infant with hydrocephalus. (Dandy and Blackfan.)

children the enlargement of the head does not take place; and it is very difficult to separate the symptoms due to the distention with fluid from those due to the meningitis or tumor. Most important are the spastic legs, increased reflexes, Babinski, etc., and the stupor, coma and convulsions

with which the case usually ends. Any or all of the evidences of increased intracranial pressure may appear—headache, choked disk, vomiting, muscular rigidity, etc. The symptoms increase rather rapidly until stupor or convulsions develop, death being only a matter of a few weeks.

Rarely there is a cessation of the process with recovery, though there is then nearly always some permanent defect.

FIG. 17.—Marked but not extreme hydrocephalus. (St. Louis Children's Hospital.)

The congenital cases sometimes live for many years, as mentioned under that heading.

Diagnosis.—Hydrocephalus practically always occurs in tuberculous meningitis, and the diagnosis is then that of tuberculosis; and in tumors of the brain the diagnosis is that of the primary disease. In other forms of meningitis the condition is to be suspected when the signs of acute illness, fever, etc., subside and there are still signs of increased intra-

Fig. 18.—Moderate hydrocephalus. Child three years old; does not walk nor sit alone; speaks only a few words; all limbs slightly spastic. Head measures 23 inches and has not increased in size for a year. Slowly improving in use of muscles and in intelligence. Note bulging forehead and the disproportion between size of head and face.

Fig. 19.—Same as Fig. 18. Front view.

cranial pressure. McEwan's sign, a "cracked-pot" sound obtained by tapping over the ventricle with the finger, is a valuable one. Increased spinal fluid is only evident when the openings from the brain into the arachnoid space are unobstructed.

Treatment. As yet there is no known treatment other than repeated spinal or ventricular puncture, or decompression operation of the skull. These are palliative procedures. Removal of the choroid plexus from the ventricles is now being tried, they being the source of the cerebrospinal fluid.

ABSCESS OF THE BRAIN.

Notwithstanding the frequency in children of the main causes of abscess of the brain, it is a comparatively rare condition in childhood.

Etiology. The most frequent cause is suppurative otitis which has become chronic, with or without mastoid involvement. Traumatism, as fracture of the skull, is an important factor. Infection from the mouth or scalp is a rare cause. Sometimes the cause is unknown.

Pathology. There is usually a single abscess. The most common site is the temporosphenoidal lobe, next the cerebellum, rarely the frontal lobe; other sites are exceedingly rare. They are rarely larger than a small orange, the contents are a mottled greenish pus, portions of destroyed brain tissue, and there is a ragged, irregular wall. The suppurating process is very slow and may remain for a long time without symptoms; sometimes the abscess becomes encysted by a dense membrane. It may rupture into a ventricle, externally through the dura, or through the ear.

Symptoms. There are usually three periods in abscess of the brain: the initial symptoms of abscess formation, a latent period without symptoms, and the active recurrence forming the terminal stage.

The initial symptoms are severe headache on the affected side, dizziness and vomiting, and moderate, continuous fever, with often local tenderness of the head. These symptoms may increase in severity, pressure signs appear,

and death occur from the violent process. Often they gradually subside and the child becomes perfectly comfortable.

The latent stage may last for months or may be of only a few days' duration. Usually there is more or less headache at times. If the abscess is so situated as to cause symptoms of a tumor, these, of course, persist.

The terminal stage presents symptoms due to the sudden extension of the process. The temperature rises rapidly, there is severe headache, vomiting, often delirium or convulsions. According to the situation, there may be various paralyses, spasticity, or muscular incoördination. Sometimes the symptoms are those of a very acute meningitis. Death takes place from exhaustion or the involvement of vital centres.

Diagnosis.—Fever, headache and delirium, without other symptoms of meningitis, are the most important signs. The location of the headache is important, particularly if there is a history of discharging ear or injury. Subsidence of the symptoms is in favor of abscess. Leukocytosis is not very high. The spinal fluid is normal, except when meningitis coexists. All the symptoms are referable to the brain, while those in meningitis may be more spinal. From tumor of the brain the differentiation is often very difficult; it is considered under that heading.

Prognosis.—Death occurs in practically every case without surgical operation. Even with skilful operation, few cases perfectly recover. But the proportion of recoveries is increasing with the greater knowledge of brain surgery.

Treatment.—During the stage of doubt the general measures to insure comfort are resorted to. When the abscess has been localized, operation should be insisted upon.

BRAIN TUMORS.

Tumors of the brain are fairly common in children, being seen occasionally even in infants.

Etiology.—Tuberculous tumors are much the most common, being as frequent as all the other kinds added together.

Glioma, sarcoma and cystic tumors are next most frequent. Syphilitic tumors are rare.

Pathology.—Tuberculous tumors are frequently multiple, but rarely does more than one of them cause local symptoms. At some time in the process there is often a localized meningitis with edema of the surrounding tissues. They are much more common in the cerebellum and brain stem. The edema may produce marked brain symptoms which are difficult to localize. The so-called "solitary" tubercle is the common lesion.

A glioma is composed of neuroglia of moderately malignant nature and probably originates in the ependyma. Its location is generally the cerebellum or pons; it may penetrate the orbit, and rarely it invades the cerebral cortex.

Sarcoma is of the same nature as found elsewhere. It is most frequent also in the cerebellum and pons, but may appear anywhere.

Cysts are of a great variety. Most common are degenerated tumors, blood cysts due to degeneration from hemorrhage, echinococcus, or softening of the brain after the lodging of an embolus. They may be found in any part of the brain, but are most often in the cerebellum or deep in the cerebrum.

Symptoms.—These are best considered under two heads—general symptoms, which are common to all intracranial growths; and the local symptoms, which depend on the location of the tumor.

Under the general symptoms the first in importance is headache, which is apt to be severe and nearly constant, but may be intermittent. It may be associated with local tenderness of the scalp. It is not nearly so constant as in adults. Vomiting is another important symptom; it is only of diagnostic value when it occurs without nausea and is sudden and very forceful.

Evident change in disposition is valuable, particularly marked irritability with periods of dulness and apathy.

Optic neuritis and papillitis are very common and usually occur early. Vertigo is frequent, especially on sudden rising or turning. Disturbances of sleep, complete insomnia, gen-

eral convulsions, and periods of wild excitement, are of common occurrence. Frequent yawning and sighing are very important signs. Continual drowsiness or stupor is usually a late and alarming sign. Convulsions are not uncommon.

The local symptoms present such an extremely wide variation that it is impossible to go into them all. In some cases these local symptoms may be lacking with the tumor in certain situations, as the parietal lobe of the right side, and portions of the temporal. The size and rapidity of the growth is, of course, important in the presence or absence of local symptoms.

In the frontal lobe the mental disturbances are important, especially the intellectual impairment. If near the third left convolution there may be motor aphasia.

Tumors of the motor area—that is, in the neighborhood of the fissure of Rolando—are apt to produce definite symptoms. Muscular twitchings, rigidity, or clonic convulsions of the face, arm or leg of the opposite side occur. Paralysis of the affected muscles may develop. These attacks of muscular spasm, with or without unconsciousness, are called Jacksonian or focal epilepsy. They may start always definitely in one group of muscles and proceed to others.

The characteristic sign in occipital tumor is a crossed homonymous hemianopsia.

Most important are the symptoms of involvement of brain stem and cerebellum, as these are the most common tumors.

When the pons is involved, there is unsteady gait, nystagmus, strabismus, and muscular incoördination. Often there is hemiplegia, and if with this is associated third nerve palsy of the opposite side, it is nearly diagnostic. Paralysis of one or the other sixth nerve, or more particularly both nerves, points to lesion of the pons, as does crossed paralysis, and involvement of the seventh and eighth nerves; if the tumor is in the upper part of the pons, the third and fifth nerves are apt to be involved.

In the cerebellum, the most frequent location, the prominent signs are vertigo and ataxia, with marked muscle incoordination, peculiar speech, nystagmus, and marked difference in reflexes on the two sides. Choked disk is very frequent.

Tumors of the medulla produce difficult swallowing, par-

alysis of the tongue, irregular pulse and respiration, or opisthotonus. There may be glycosuria, polyuria, loss of voice, and crossed or uncrossed paralysis, or sensory disturbance of the extremities and trunk. The choked disk is rare.

Diagnosis.—Abscess of the brain is most likely to confuse, but this is not of much importance, as the treatment must be the same. The fever and leukocytosis are the most important differences; also the history of infection or injury, the frequent irregular progress, lack of choked disk, and infrequent localizing symptoms. Meningitis may be excluded by lumbar puncture; otherwise the tuberculous variety may present identical symptoms in rare cases. Of course tuberculous tumor and meningitis may both be present. The *x*-ray of the skull is of much value.

Prognosis.—The progress is often slow, but in most cases the child grows steadily worse and death results. Tuberculous tumors may become quiescent; luetic ones may disappear. With recovery there is usually some permanent brain destruction.

Treatment.—No effect on the tumor can result by medicinal measures except in the case of syphilitic ones, which are very rare. If there is any suspicion of this, potassium iodide and mercury should be given over long periods of time. In other forms the usual sedatives and narcotics must be given as indicated. If definite localization can be made out, operation should be advised. Often the operation of decompression will markedly relieve the symptoms.

INFANTILE CEREBRAL PALSY.

These paralyses are due to injury or maldevelopment of the cortical substance or injury to the bloodvessels with subsequent loss of cortical function. Recently a form of paralysis associated with idiocy has been described by Pierce Clark and called cerebrocerebellar palsy, but the great majority of the cases show only cerebral involvement.

Etiology.—The cause may operate before birth, occur during parturition, or occur in infancy or childhood. By far the commonest cause is hemorrhage from the meningeal vessels.

The intra-uterine causes are porencephalus (perhaps due to hemorrhage), cysts, and failure of cortical development. The acquired form may be due to trauma, hemorrhage, embolus, or adhesions of the membranes; sometimes no cause whatever can be found. Pertussis, syphilis and meningitis are the commonest diseases with which it is associated; it may occur in scarlet fever, measles, diphtheria, pneumonia, etc.

Pathology.—There is usually a large hemorrhage from the meninges, resulting in symptoms of marked cortical irritation, and later in atrophy of the cortex. All degrees of destruction and sclerosis may exist, due to chronic meningo-encephalitis, or cysts within the brain substance.

The changes are much the same in the prenatal and birth palsies. The acquired form usually shows a meningeal hemorrhage, rarely cerebral hemorrhage, thickening and adhesions of the membranes, embolus from endocarditis, causing occlusion of a branch of the middle cerebral artery, or very rarely thrombosis of the great sinuses.

Symptoms.—The prenatal form is usually a paraplegia or diplegia. Nearly always there is some mental impairment, often complete idiocy. There may be a general flaccidity of all the muscles instead of the spasticity so typical of cerebral palsies.

Diplegia and paraplegia are much the most common birth palsies; hemiplegia next, and monoplegia very rare. The cases of hemiplegia and monoplegia do not usually come under observation until the child should walk, or until several years of age. The para- and diplegias are usually evident enough to attract notice in a few months. The chief symptom is the marked stiffness, usually of the legs, perhaps also of the arms, or of the whole musculature. The reflexes are all greatly exaggerated, purposeful movement may be almost impossible, and the children are generally weak and delicate. The spasm of the leg adductors is typical, the legs crossing one another when the child is held up on his feet. In cases of less severity this spasm may only be noticed by the mother because of difficulty in applying the diaper. Many of these cases soon show mental deficiency, and from 30 to 40 per cent. become epileptics, if they live long enough. The cases of hemiplegia are

nearly always in better general condition, and the paralysis may not be noticed for months or years. Sooner or later it is seen that the child runs awkwardly, falls easily, uses one arm poorly, etc. Then examination reveals the stiffness, sharp

FIG. 20.—Infantile cerebral palsy. Spastic paraplegia with marked spasm of adductors. (St. Louis Children's Hospital.)

reflexes, and poor control of the affected limbs. Any of these cases are likely to develop irregular choreic movements that are uncontrollable, or the slower, worm-like movements known as athetoid.

The great majority of the acquired cases are hemiplegias. The others do occur, usually in infancy, and do not differ from the birth palsies. The hemiplegia comes suddenly, usually after one or more convulsions with loss of consciousness. Face, arm and leg may be involved, more often only the arm and leg. If the left side of the brain is involved, there may be loss of speech. After the acute symptoms subside there is a spastic palsy of the affected part. The face may recover entirely; often there is marked improvement in the arm, and even more rapid and complete in the leg. Usually some permanent stiffness results in the leg, more in the arm, and the increased reflexes, Babinski, ankle-clonus, etc., show the cerebral involvement. There is nearly always some atrophy of the muscles, and there may be marked contractures. Sensation is perfect and the electrical reaction normal. The intelligence is usually not at all affected, as it so often is in the infantile forms.

Diagnosis.—This rests on the history, the spasticity, increased reflexes, normal electrical reaction and perfect sensation. The flaccid type may be difficult, but here there is usually mental impairment and little or no atrophy, with normal electrical response. The acquired form may suggest meningitis in its onset; but the quick recovery from the acute symptoms and the residual paralysis make the diagnosis.

Prognosis.—In the prenatal and birth palsies the outlook is bad, either as to life or proper intelligence. The prospect of epilepsy is very discouraging. Little can be done for the paralysis. In the hemiplegias the outlook is very much better. In some the paralysis completely recovers, or improves so much that it is of no great importance. The mental defects are not nearly so common, in fact, most acquired hemiplegias, except in infants, have no mental impairment.

Treatment.—For the prenatal and birth cases nothing can be done except attempts to teach the child to use the muscles, or operation to correct contractures, etc. Results by these means are not encouraging. In the acquired form the convulsions or other severe cerebral symptoms are treated by sedatives, ice to the head and neck, and subsequent perfect quiet; the paralysis is never suspected until it is manifested

some time later. When all acute symptoms have subsided, massage and passive motion may somewhat relieve the spasticity; the trouble is not in the muscles, it is in the brain. Education in the use of the limbs, systematic exercise, and braces or operation for contractures are indicated. Recently the operation to sever certain of the posterior spinal nerve roots has been performed to lessen the spasticity; some good results have been reported, but they constitute a small minority. It should be done only in otherwise hopeless cases.

If cerebral hemorrhage is strongly suspected at or soon after birth, operation is indicated; some good results have followed operation, and these cases are practically hopeless otherwise.

FACIAL PALSY.

This has been described as it occurs in the newborn. It may also occur at any later time, principally from exposure to cold, from disease of the middle ear, and rarely from other causes. The common variety is the peripheral palsy; central paralysis is very rare.

Pathology.—In the great majority of cases there is none. Cases due to ear disease, or those of very long standing, may show degeneration of the nerve fibers. If the paralysis is permanent or of very long standing, there is muscular atrophy.

Symptoms.—The paralysis comes suddenly and in most cases with no adequate explanation of it. The entire side of the face is paralyzed. That side is smooth, attempts at showing the teeth, smiling, whistling, closing the eye, or wrinkling the forehead, show the lack of muscular power on that side; the tongue, when protruded, is drawn toward the paralyzed side. Talking, eating and drinking are interfered with to a slight extent. Sensation is normal. The faradic response is feeble; in severe, prolonged cases there is the reaction of degeneration.

Prognosis.—There is nearly always perfect recovery, except in the cases where the nerve is actually injured by inflammation or trauma. If it occurs as a part of a hemiplegia, the prognosis is that of the cerebral palsies, but this is a very different type.

Treatment.—In the early stage counter-irritation with mustard is indicated. Later faradism, strychnin and daily massage have some effect. Most cases recover with no treatment but careful protection.

TORTICOLLIS.

This is a continuous spasm of the sternomastoid muscle on one side, sometimes also the trapezius, etc., resulting in the head being turned constantly to one side.

Etiology. Acute attacks are nearly always due to cold. Those developing slowly are due to enlarged glands pressing on the spinal accessory nerve, to cervical Pott's disease, and to malaria. Cases following measles, scarlet fever, diphtheria, etc., are usually due to large glands. In the newborn it is sometimes seen, due to faulty position *in utero*.

Symptoms. The head is rotated away from the affected muscle and bent slightly toward it. If the posterior muscles are affected, the head is inclined slightly backward, and rotated away from the affected side. Rarely there is some pain in the beginning, and some tenderness over the muscles.

Prognosis.—The majority of cases recover completely, these being due to exposure, and to the acute diseases. The outcome depends on the amount of injury to the nerve. If the duration is several months, the likelihood of complete recovery is small.

Treatment.—If any condition can be found which is responsible for the spasm, it should receive appropriate treatment. Acute cases require rest and counter-irritation, with no attempt to correct the deformity. Chronic cases should have orthopedic treatment. After a number of months division of the muscle or tendon is usually necessary.

THOMSEN'S DISEASE.

This is called also *congenital myotonia*. It is a condition of spasmodic rigidity of the muscles, the cause of which is quite unknown. Heredity is probably a strong factor, as it may occur in several members of a family. It is usually congenital, and is very rare.

Symptoms.—The characteristic of this disease is the spasmodic rigidity of the muscles when attempt is made to use them after a period of repose. As the attempt to use them is persisted in, the rigidity passes off. Most commonly the legs are affected, and the condition noted in walking; the arms may be affected. The muscles are abnormally sensitive to mechanical stimulation, but reflexes and sensation are normal.

This disease is never fatal in itself, and is never cured. Nothing seems to have any effect on the progress of it.

OPPENHEIM'S DISEASE.

Although apparently not a disease of the nervous system, this is such a striking contrast to the above that it seems desirable to briefly describe it here. It is known as congenital myatonia, on account of the marked flaccidity of the muscles.

The lesions are chiefly in the muscles, but it is possible that degeneration of the anterior horn cells causes part of the symptoms; they have been found reduced in number, and the anterior roots diminished in size.

The condition is usually noticed soon after birth, showing a decided loss of power in the legs and thighs. Later the arms and the trunk muscles are affected. Soon the loss of power is nearly complete, the infants making no move other than breathing and swallowing. The limbs are flaccid and flail-like, dropping lifelessly when lifted, and remaining in whatever position they are put. Reflexes are diminished or lost, electrical reactions feeble, but no reaction of degeneration. There are no subjective symptoms. The infants may be well nourished for many months.

They usually die before the first year of some acute illness, because of inability to withstand disease. The condition is hopeless and *treatment* is of no avail.

MENTAL DEFICIENCY.

All degrees of deficient intellect are seen in children, due usually to congenital defect, but also to disease of the brain in

infancy or childhood. We are also beginning to realize that there is often a moral delinquency that may be congenital, or due to disease, or due to (or at least increased by) improper association and surroundings. The grosser defects are known to be due to a number of causes. Arrested development of the brain, hydrocephalus, microcephalus, the causes producing cerebral palsies, and epilepsy, either idiopathic or acquired. Whether the lesser defects are due to the same things operating in a less degree is not known.

It is of some importance to be able to differentiate between idiots, imbeciles, and children who are merely stupid and slow about learning. The first can be seen to be deficient by anyone who looks at him; education of any sort is practically impossible. The second is possessed of sufficient intelligence to learn many kinds of simple work, and should be so placed as to allow what training he is capable of to be exercised. The third class needs, and is deserving of, very careful training by persons specially skilled in such teaching. These backward children rarely do well in school with children of normal faculties, but may acquire a fair education and be perfectly well prepared to take care of themselves if they are educated in the proper way by competent teachers. They present a class that has been shamefully neglected in the past, and is being to a large extent so neglected today. The physician should give these backward children very careful scrutiny if they are brought to his attention, and discover, if possible, what the mental capacity is and how it is to be best developed. It should not be forgotten that many cases of such stupidity are due to large adenoids, defective vision or hearing, or to almost any sort of chronic bodily illness or malnutrition.

Probably a still larger class that needs exceedingly intelligent handling, and great sympathy and forbearance, are the moral defectives—the so-called incorrigible children that have of late years been properly put in charge of the juvenile court in many cities. This is one of the wisest moves ever made for the betterment of children. Such children may be perfectly normal in intelligence as far as any sort of mental tests can discern. They may learn readily at school, behave well, be

quite amenable to discipline and control, but their deficient morality is manifested in any one of a hundred ways, and they are finally found to be untrustworthy and totally lacking in one or more of the cardinal virtues. Without proper, wise guidance, correction and occupation, they sooner or later commit some act that brings them into conflict with the law, or they are found to be quite beyond the parents' control. To be sure, not all such children can be picked out with any degree of accuracy before the stage in which they get beyond control. And many are found to be uncontrollable simply from an exuberance of spirits that will spend itself in time, leaving them perfectly normal, respectable adults. But the jails and reformatories are poor places in which to correct the tendencies of those who really are mental deficients, and it seems likely that the physician may often give the needed advice to parents who are at their wits' end to know what to do with wayward children. Healthful, interesting occupation, away from temptation that might be engrossing, and the supervision of some wise, sympathetic man or woman, well versed in the ways of children, and their desires and needs — these are the essentials in making valuable citizens out of prospective criminals.

There are certain forms of deficient mentality that present such typical features that they have been given distinctive names.

Of these *Mongolian idiocy* is the most common. The face is almost distinctive, the downward and inward slant of the palpebral fissures being apparent at a glance. The face is rather round, the bridge of the nose flat and broad, and the nose looks small and up-tilted. The tongue is broad and becomes very rough and fissured in childhood. The mouth is constantly open, and the tongue often in motion in and out of the mouth. The head is somewhat flattened from before backward. These children do not sit up until perhaps a year or two years old; dentition is delayed, walking and talking are very late, and often they never learn to talk intelligently. They are little resistant to disease, and usually die in early childhood. A point of differentiation from cretinism lies in the hands; the Mongol has short hands that taper normally,

the thumb and little finger are apt to be unusually short, and often the little finger has a decided curving toward the third finger. The joints are extremely loose, which permits the most remarkable contortions.

FIG. 21.—Mongol, ten years old. Showing splendid physical development. Compare with cretin. (St. Louis Children's Hospital.)

Amaurotic family idiocy is a very rare condition which, as its name implies, is a congenital blindness coming on with idiocy. Nearly all recorded cases have been Jews; nothing else is known of the etiology. Two or more children have been affected in the same family. At birth the child appears normal. By the sixth or eighth month it is noticed that the child is weak, does not make the ordinary baby movements, and takes less and less interest in anything. The weakness

becomes so marked that the child will not move, the intelligence is evidently diminishing, and in some way it is discovered that the child cannot see. The muscles are weak and flaccid, but usually become rigid after several weeks or months, with marked reflexes and spasticity. Convulsions often develop before death, which occurs in every case by about two years. The ophthalmoscope shows atrophy of the optic disk, and a characteristic cherry-red spot, surrounded by a white area, in the place of the macula lutea.

FIG. 22.—Mongolian idiocy. Interesting in showing similarity of face to cretinism and to adenoid facies. Marked mobility of joints; baby sleeps in this position. (Dr. W. W. Duke.)

Diagnosis of Mental Deficiency.—This necessitates first a familiarity with the growth and development of infants. Most of the defects are congenital, or develop in infancy. The normal infant holds up its head and plays with simple toys at about four months; it can sit alone at about seven months; attempts to walk, or can stand with assistance at about twelve months; speaks single words at one year, and

can usually form simple sentences at two years. Any great deviation from all of these is abnormal. It is then necessary to determine whether or not there is any physical disability to account for the backwardness, such as malnutrition, rickets, poliomyelitis, etc. If none can be determined, the trouble is probably mental. A great deal of stress is laid on the facial aspect as an indication of mental defects. Often the expression, or lack of it, is significant; but in many infants the facial expression is perfectly normal with complete idiocy; it may be so even in early childhood. But the manner of playing, of laughing or crying, etc., usually displays the low intelligence. In older children idiocy and imbecility are readily recognized. But backwardness and persistent waywardness will tax the ability of the wisest to determine the degree, the probable outcome, and the proper course to pursue.

CONVULSIONS.

General tonic and clonic contractions of the entire somatic musculature are common in infancy, and frequent throughout childhood. They may be manifestations of cerebral disease, but very often occur in perfectly normal children during some acute, and even very slight, illness.

Etiology.—The general cause may be anything that increases the irritability of the cerebral cortex. The instability of the nerve centres and the lack of development of the voluntary centres in the cortex are very manifest in infancy, and to a less extent in older children. Certain children have a marked predisposition to the convulsive state, as mentioned under Spasmophilia. Rickets is a frequent predisposing cause, or any other marked state of malnutrition, anemia, syphilis, etc. Active, inciting causes are any disease of the brain or meninges; acute intestinal disorders; any acute disease associated with high fever, particularly malaria, pneumonia, scarlet fever, etc. In pertussis they are more common than in any other infection, but here they are caused by the congestion following prolonged coughing spells and are consequently a late development. Reflex causes are intestinal worms, phimosis, and rarely difficult dentition. Enlargement

of the thymus gland is sometimes the apparent cause of convulsions, in the condition known as status lymphaticus. Of all causes, the most frequent is irritation of the digestive tract from undigested food, food intoxication, or infection.

Pathology. It is probable that the condition of the brain in the beginning of a convulsion is one of anemia. Very soon there results a very marked venous congestion of the brain and meninges. Minute hemorrhages may result, or even extensive ones, with permanent brain injury. When death occurs during a convulsion, the lungs are found engorged with blood and the right heart distended.

Symptoms.—Usually the attack comes on without warning. The eyes become fixed, generally toward one side, the face is pale, breathing is superficial or stopped entirely. Very soon slight muscular twitching is noticed in one group of muscles, most often one side of the face, or the arm or leg; these rapidly increase in intensity and extend until the whole body is stiff, the face distorted, the head held back, hands clenched, and the arms, legs and back quite rigid. Consciousness is lost. The tongue may protrude from the mouth and the saliva become frothy. By this time the face is congested, usually cyanotic, breathing very slight or unnoticeable, and rattling sounds produced in the throat. In this stage the appearance is very alarming. Usually there soon develop violent clonic contractions, with jerking of the arms and legs; these gradually subside, deep, slow breathing begins, the body becomes quite lax, and the child remains in a profound sleep. The jerking of the eyes, frothing mouth, remarkable facial grimaces, and the color of the skin, make a terrifying picture for the mother to witness.

Death may occur in the first attack, and in infants it is a particularly alarming condition if they are weakened by disease. But death is rare in a child previously healthy.

Diagnosis. This is entirely concerned with the cause of the convulsion. In newborn babies the possibility of tetanus must be considered; cerebral hemorrhage is the strong probability. In older infants it should never be taken for granted that the cause is acute intestinal disturbance, though this is the most frequent cause.

Prognosis.—A single convulsion rarely is fatal, even in very young infants. If the child is very weak, it may succumb. Or if it has a large thymus, this may produce a fatal result. Those due to the onset of acute fever, to reflex irritation, or to slight causes in particularly susceptible children, are especially benign. In whooping-cough they are a very bad sign, or late in the course of any disease of the respiratory tract. Recurrences make the prognosis worse; one should then be on the lookout for evidences of epilepsy.

Treatment.—During the convulsion cold should be applied to the head and heat and counter-irritation to the body. The mustard pack or bath is the quickest and most efficient means, but it has probably been used by the time the physician is summoned. Indeed, the spasm is frequently over by the time the physician arrives. Chloroform is the most effective drug to control the condition. If the convulsion does not subside quickly by other means, it should be used, even on young infants; usually a very few inhalations are sufficient. After it is controlled, a solution of bromide and chloral in about an ounce of warm water is injected high into the rectum and retained in the bowel by compression. Four grains of bromide and two of chloral may be so given to a child of six months. Repetition of the dose may be needed in an hour or two. If this does not suffice to prevent convulsions, morphin is to be used; its effect is quick and certain. A six-months infant may be given $\frac{1}{5}\frac{1}{0}$ grain hypodermically, repeated if necessary in twenty minutes; a two-year-old may be given from $\frac{1}{2}\frac{1}{0}$ to $\frac{1}{1}\frac{1}{0}$ grain. If the convulsion is due to asphyxia, as in pneumonia or pertussis, inhalation of oxygen may be of great benefit.

After the spasm is controlled, it is wise to give an efficient cathartic, followed in two hours by an enema, if the child is well under the control of the sedatives. If the temperature is found to be high, it must be kept down by cold packs. Every effort must be used to discover a possible cause. If it appears to be a susceptible child, great care should be taken with diet, manner of life, etc. Often the general condition needs attention, as in rickets.

HEADACHES.

Headaches are fairly common in older children, the causes being in no way different from those of adults. Infants do not often have headaches, or at least symptoms are difficult to so interpret; young children are little subject to them, except with organic disease of the brain.

Etiology.—The commonest causes are anemia and malnutrition in general; chronic constipation, particularly in the attacks of acute illness due to indigestion; the onset of many acute infections, particularly meningitis, scarlet fever, malaria, and influenza; uremia, subacute rheumatism, or inherited nervous tendency, particularly in epileptic and hysterical children; sinus infection, adenoids, or other nasal obstruction; refractive trouble in the eyes, rarely keratitis and iritis. Many children have frequent headaches for which there is no other explanation than an unstable nervous system. Another class are those subject to the so-called sick headaches, in which there is severe nausea and vomiting with prostration; these are probably the same as the adult migraine. Any sort of organic disease of the brain or meninges may be accompanied by headaches, particularly cerebral lues.

Symptoms and Diagnosis.—This is of itself only a symptom. The cause should be found and eliminated. In infants and young children it is extremely difficult to determine the trouble, or often whether it is really headache that is causing the evident discomfort. Severe, persistent headaches should arouse suspicion of organic disease of the brain. The locality of a headache, in older children, seems not to be of much importance. If it occurs regularly the first thing in the morning, the frontal sinus should be examined; if regularly after being the whole day in school, the eyes may be at fault. Anemia, digestive disturbances, mental strain, and constipation should always be looked for. Often the most painstaking examination will reveal a fault that would be quite overlooked without it. The urine must always be examined for a possible nephritis.

Treatment.—This is necessarily directed to the cure of the condition causing the headaches. For the relief of the pain

itself the most valuable drug is phenacetin, which is the safest of the analgesics; it may be more efficacious combined with caffeine or aspirin, or both—all of them in moderate doses, repeated as needed. Cold to the head, with a hot mustard foot-bath, often gives relief.

DISORDERS OF SLEEP.

These are extremely common in childhood, though often of transient nature. They are not comparable to the insomnia of later life; this is rare in children.

Etiology.—In infants restless, fitful sleep is most often due to hunger or to overfeeding or improper feeding. It is commonly seen at the time when a baby should be taking some solid food, and is given an insufficient amount in the evening. Often the restlessness becomes a matter of habit because of too much attention at night. Minor troubles, such as slight colic, catarrhal otitis, being too warmly clothed, etc., may be the cause. In older children also the commonest cause is improper feeding, or chronic intestinal indigestion. Enlarged tonsils and adenoids, too much or too little clothing, too many people sleeping in one room, insufficient ventilation, all are often the causes of poor sleep. Violent or exciting play just before bedtime, exciting, fearful stories, or fright of recent occurrence may be the cause. A condition called pavor nocturnus, in which the child wakens in the night in a state of fright and requires considerable quieting before he is able to go to sleep again, is likely to be a result of any sort of sleep disturbance, particularly from fright, adenoids, or difficult respiration from heart disease, asthma, etc.

Symptoms.—Generally there is only restlessness, tossing or moaning, with frequent awakenings and going to sleep again. There may be great difficulty in going to sleep, amounting to true insomnia, but such a condition is usually of short duration. Night terrors are as mentioned above; but there is a form in which the child wakes in great fright at some dream he has had, appears quite conscious, and is prevailed upon to go back to sleep; next day he has no recollection of it. These attacks may be repeated at considerable intervals.

Prognosis.—Unless sufficient sleep is lost to make the child appear ill from it, there is usually no cause for apprehension. The sort of night terror without full consciousness and without recollection is apt to be the forerunner of serious functional nervous trouble.

Treatment.—As this condition is but a symptom, it follows that the treatment is that of the condition causing it. Particular attention should be paid to feeding, a proper and sufficient supper, and free ventilation of the sleeping room. Letting such a child very much alone at night is sometimes productive of results. Often a warm bath before going to bed is effective. Drugs should not be used to induce sleep unless the child is ill with some known condition. Occasionally it is allowable to use a mild sedative when the cause is discovered and corrected and the child still very restless from habit or strain. This should never be continued more than one or two nights.

SPEECH DEFECTS.

Disturbances of speech are common in childhood, being due either to functional inability or to mental deficiency. Children who cannot hear, of course do not learn to talk except by long, skilful teaching. Of the functional defects, the most common are stuttering, lisping, and late development; aphasia and alalia are rare.

Late Development.—Normal children should be able to form intelligent sentences at the age of two years. Prolonged illness, very slow physical development with a great deal of pain and discomfort, may delay the appearance of speech. Seeing very few people, and those few inclined to be taciturn, will naturally make speech development slow. But a child of two years, in ordinary surroundings and health, who does not talk, should be suspected of organic defect.

Stuttering.—This is the most frequent speech defect. It occurs so often in early childhood that it can hardly be considered a defect until after the fourth year. There are two varieties, one in which the difficulty lies in connecting a consonant with the following vowel, and the other, more correctly called stammering, in which there is difficulty in pro-

ducing certain sounds. The former often follows severe illness, is due to imitation, or arises from natural hesitancy and self-consciousness. The latter is usually due to some abnormality of the lips, tongue, or palate.

Careful training, instruction, or the correction of anatomical defect will practically always effect a cure.

Lisping.—This is commonly considered to be an inability to produce the sound of "s." It may be so exaggerated that all sounds are imperfectly produced and the speech be very difficult to understand. In the milder forms it may simply be a habit, and may be noticed only during excitement. In more pronounced cases it is due to some defect in the tongue, lips, etc. It is usually overcome by careful, prolonged instruction, or correction of anatomical defect.

Aphasia.—Functional aphasia occurs in severe attacks of chorea, from severe fright, and during hysterical attacks. It may follow prolonged illness, particularly typhoid fever. It always recovers without any special treatment.

INJURIOUS HABITS.

The child is a creature of habits, good and bad. It is easy to allow a child to develop a bad habit, and not at all easy to develop the good ones. Consequently the list of possible injurious habits is a long one. The most common ones will be briefly considered.

Sucking.—This is exceedingly common in infants. They will nearly always suck the fingers and thumb to a certain extent. It may be the toes, lips, tongue, part of the hand or arm, clothing, or the universal "pacifier." Any such tendency may become a very distressing habit, or it may be controlled by keeping the child from doing it; the former is much easier for many reasons—the latter much more advisable for more reasons. Prolonged habit of this kind may result in deformity of the thumb, teeth or lips. When the habit is associated with the tendency, sometimes seen, to rub some part of the body while sucking, the habit of masturbation may be formed.

The tendency should always be stopped before it becomes a

fixed habit. It may be necessary to put splints on the arms to keep the hands from the mouth. The longer the habit is allowed to continue, the more difficult it is to stop it.

Masturbation.—Physicians should remember that masturbation is not at all uncommon among infants of both sexes, even in the first year. It is more common in girl infants than boys. It may result from any sort of irritation of the external genitals, resulting in the child rubbing the parts and experiencing a pleasurable sensation. Forms of play which result in rubbing of the genitals may direct the child's attention to those parts. In later childhood the habit is usually taught by playmates or older persons. Certain children develop the habit more readily than others, particularly neurotic children and those inclined to play much by themselves and who have besides a vivid imagination. Children of deficient mentality frequently masturbate excessively.

The manner of masturbation in infants is usually so obscure that the real cause would never be discovered unless noticed by someone with special knowledge of the condition in infants. Oftenest it is accomplished by rubbing one thigh over the other or rubbing against some object, as a chair leg, pillow, etc. Later in childhood manual friction takes the place of the former means, unless the habit is corrected.

In older children the habit is vastly more common among boys, but its particularly bad effects are more noticeable in girls. Here it may also depend on local irritation, but is more often a matter of being taught. Anemia, malnutrition, anything that makes the child more nervous or irritable, sleepless, etc., is apt to increase the tendency. Healthful occupation, preventing opportunity to practise the act, explanation and persuasion, must be used to attempt to break the habit. This is very difficult, the utmost tact must be used, and usually punishment, except in very young children, is of little avail. Local irritation or general disability must be treated as indicated.

Habit Spasm.—Children sometimes develop certain spasmodic contractions of a group of muscles that may result in a distressing habit. Most frequently they are movements of the eyes, blinking, raising the brows, or of one side of the

mouth, suddenly turning the head, raising the shoulders; sometimes there is a frequent, deep sigh, or a short, affected cough. It is simply a sign of a neurotic tendency and leads to no bad results, but it may be very difficult to control and very distressing to the child and the family. Too much work in school, eye-strain, teasing or scaring by playmates, and many other causes of minor irritation or discomfort may result in habit spasm. Treatment is that of the general or causal condition. As little attention as possible should be directed to the infirmity, as the child is usually too conscious of it already. Rewards for improvement may be effective.

EPILEPSY.

Definition.—This is a disorder of the brain characterized by convulsive seizures of any degree, with impairment or loss of consciousness, and which recur from time to time over a period of years.

Etiology.—There are two distinct types, from an etiological point of view: those due to actual injury of the brain, and those in which no injury has occurred. Of the former, by far the greatest number are due to hemorrhage, etc., such as produce the cerebral palsies. Epilepsy may not develop until years after the lesion is produced.

The so-called idiopathic cases are frequently due to hereditary nervous taint. They may begin as early as the first year, but much more often after the tenth. The time when the tendency is most manifest is about the time of puberty. The exciting causes which produce the first convulsion in epileptic children are many. Great excitement, marked irritation of any sort as from adenoids, foreign bodies in ear, nose, etc., stubborn constipation, or genital irritation. Improper functioning of the pituitary gland is an occasional cause.

Pathology.—The only discernable lesions are those of the diseases which cause the symptomatic epilepsy. There is no pathological abnormality in the brain of idiopathic epileptics.

Symptoms.—There are two general types of this disease: those in which the attacks are violent, called grand mal; and

those in which there is slight motor disturbances or none, called petit mal.

Grand mal is a convulsion in all respects similar to those described under Convulsions. A characteristic feature is the frequent premonitory sign, called the aura. This is a peculiar sensation of some sort, presenting in different patients the widest variation. Sometimes it is a tingling of some part of the body, a feeling of nausea, chilly sensation, giddiness, a flash of colored light, or an endless variety of motor or sensory phenomena. Before long the child recognizes this feeling as the sign of an impending attack. Another characteristic is the suddenness of the seizure, in a child in perfect health. The victim often falls to the floor and sustains severe injury, being unable to seek protection before unconsciousness develops. Frequently the child feels sluggish and out of sorts for several hours or days before a convulsion. Afterward there is a decided improvement in the general feeling.

The child often falls with a sharp, wierd cry. The pallor, fixed eyes with dilated pupils, frothing at the mouth, clenched jaws, etc., are the same as described under Convulsions. The rigid, tetanic contractions of the body are succeeded by the clonic, jerking contractions in which every ounce of muscular force seems to be expended. The cyanosis, interrupted breathing, and choking sounds in the throat are the same. The tonic state may last only a few seconds; the clonic may last from two to twenty minutes, or even longer. Usually the convulsion is followed by a deep sleep of one to three hours. Less often there is a gradual return to consciousness, the child being in a dazed condition and having no recollection of what has happened. The muscular contractions may be so violent as to cause fracture of a bone, or rupture of a muscle. Fractures of the skull have occurred from the fall. The tongue is often deeply lacerated by the teeth.

Petit mal is an attack of momentary unconsciousness without any convulsive seizure. The child may suddenly stop what he is doing and stare fixedly for a few seconds; then look about in a dazed sort of way as though wondering what had taken place. Following the attack there may be a short period of confusion or stupid actions. Aura are not as fre-

quent as with the other variety, but they do occur. A great many seizures may occur in a single day.

Diagnosis.—Major attacks are known to be epilepsy only when they occur without ascertainable cause in children otherwise healthy, and are known to be recurrent. A diagnosis of epilepsy cannot be made on a single attack, as the convulsions do not differ from the ones in acute fevers, etc. In these, examination of the urine, to exclude uremia, and the presence of fever or other symptoms of disease, must be ascertained. The greatest difficulty is in determining whether the epilepsy is secondary to gross brain lesion, or whether it is idiopathic. Careful history and repeated observations may be necessary to decide this. Spastic paralysis of any of the limbs must be looked for. Constipation is very frequent and stubborn.

Petit mal is often exceedingly difficult to interpret. When it is evident that the slight seizures are accompanied by unconsciousness, and that the child has no recollection of them, the diagnosis is fairly certain.

Prognosis.—Danger to life is slight. Serious injury may result from the falls. Spontaneous recovery is very rare. The prospect of cure is slight in cases who have had many convulsions. The results of frequent convulsions are disastrous, as mental impairment, and even idiocy, nearly always results. If the convulsions can be demonstrated to be due to some error in living, or some removable bodily defect, a cure frequently results. Even then recurrences are not uncommon. Cases secondary to brain injury are rarely amenable to treatment.

Treatment.—If the repeated, careful examinations reveal any possible cause for the attacks, it should be attended to. If there is none the results of medical treatment for the epilepsy are extremely disappointing. The diet, manner of sleeping, exercise, etc., should be carefully regulated. None but the most wholesome food should be given, and sweets, pastry, tea and coffee, and other non-essentials cut down. Constipation should be particularly watched, for the majority of these children are obstinately constipated. During the attack there is nothing to be done except to see that the child does

not chew the tongue; or, if possible, prevent him from falling or from jerking out of bed, etc.

The drug of most value in controlling the spells is bromide of sodium or potassium, always used in combination with the proper diet, fresh air, occupation, etc. Bromide should be given in sufficient dosage to moderate or entirely control the convulsions; only trying will discover what the proper dose is for an individual; usually thirty grains a day is necessary for a ten-year-old child, but this will depend on the number of seizures, and many other factors. Often combining with belladonna increases the effect, particularly in petit mal. After the convulsions are controlled, the dose should be reduced as much as possible without their recurrence. Indigestion, constipation and skin eruptions may result from prolonged use. Bromipin (bromine dissolved in oil of sesamum) is often better borne. Good results have been claimed from the use of large doses of calcium lactate, but most users have not had much benefit from it. Chloroform or chloral are useful in the very long-continued convulsions (the status epilepticus), but this is rather rare in children.

Surgical measures to relieve pressure on the brain in cases of injury or new growth have been tried in many cases and have been successful in a few. There is no surgical indication in idiopathic epilepsy.

The education of epileptics is a difficult matter. Usually it is best that they be not in school, but they should by all means be educated and taught some means of becoming self-supporting, if possible.

HYSTERIA.

Definition.—This is a purely functional nervous state which may simulate the widest variety of pathological processes. It is quite rare in children until the age of puberty.

Etiology.—It is exceedingly rare before the sixth year. It becomes less rare later in childhood, and most cases are seen after the twelfth year. Heredity is a very important factor, particularly when combined with lax discipline on the part of the parents. Malnutrition, anemia, too much study in

school, or any sort of mild, chronic irritation may be the exciting causes. Not rarely a combination of lack of restraint, irregular eating of candy and sweets, and late hours at night, produce hysteria in children otherwise well taken care of. It is more common in girls than boys, though not so much so as is the case in adults.

Symptoms.—A description of the symptoms of hysteria would have to include those of most of the nervous diseases, and many diseases of almost any other part of the body. It is essentially a disease of imitation, but there are certain characteristics of the condition that usually permit a diagnosis by careful examination. First are the evidences of unusual nervousness, outbreaks of laughing, crying, great depression, fierce anger, etc. Poor sleep with vivid dreams, night terror, or somnambulism are common.

Most constant are the disturbances of cutaneous sensation, particularly local hyperesthesia or anesthesia, perhaps both being present in different areas. Severe localized pain may lead to a diagnosis of appendicitis, pleurisy, meningitis, etc. There may be complete blindness or deafness.

Pain in the joints, with rigidity, deformity, increased pain on manipulation, and refusal to move the member, may simulate joint or bone disease so closely as to be extremely puzzling. There is nearly always cutaneous hyperesthesia of the limb, back, or neck, whichever is affected; rarely local anesthesia. The joints of the lower limb and the spine are most often affected. Closely allied to these symptoms are the frequent muscular spasms of any group of muscles, most often of the face, neck, and larynx; eructations of gas from stomach contraction, hiccough from the diaphragm spasms, cough, vomiting, and a long list of others. The joint symptoms are apt to be mistaken for true paralysis, and indeed it is often difficult to decide which it is. The muscular contractions may be so violent as to produce convulsions similar to those of epilepsy but without loss of consciousness; these are very rare in children.

Diagnosis.—These children are usually poorly nourished or have an evident neurotic temperament. Often the symptoms are so disconnected that they can be due to nothing

organic. Most important are corneal and pharyngeal anesthesia, or marked disturbance of sensibility anywhere, lessening of the visual field, modification of taste, smell and hearing, and unimpaired intelligence. Often organic disease can be excluded only after repeated observations.

Prognosis.—This is difficult to make in any given case. The course is essentially chronic, and the longer the symptoms last, the darker is the outlook. In children with very marked neurotic temperament the hysterical tendency may be impossible to overcome. When the trouble is due to anemia, malnutrition, or vicious home conditions, striking improvement usually follows their correction.

Treatment.—Everything possible should be done to improve the general health and nutrition of these children. Healthful occupation and play should be arranged; excitement of any kind, highly imaginative reading, theatres, etc., should be avoided, as should improper playmates.

Often a great deal is accomplished by removing such a child from the influence of family and friends, and putting him under the charge of a suitable individual who will treat him with the proper firmness and tact.

Hysterical symptoms may call for treatment as they arise, and no effort should be made to make the medicine pleasant, or to make the general condition exceptionally comfortable. Coddling and sympathy have no place in the treatment of hysteria. Definite counter-irritation, electricity, cold douches; bitter mixtures, aromatic spirits of ammonia, and tincture of valerian—any of them are of occasional effect in the attacks. Prolonged rest and solitude are advisable after evident hysterical manifestations.

CHOREA.

Definition.—The popular name for this condition is St. Vitus' dance; the original St. Vitus' dance is really the major attacks of hysteria, but the name has now become firmly established as that of Sydenham's chorea. It is a functional neurosis characterized by irregular, purposeless movements of the muscles of the face and limbs.

Etiology.—It occurs with much the greatest frequency between seven and fourteen years, and twice as often in girls as in boys. It is exceedingly rare under five years, and practically unknown in infancy. It is much more frequent in the spring, and in children with a nervous, excitable temperament. Very many of these children are anemic; often they are just recovering from other illness, particularly typhoid fever, influenza, and scarlet fever. They often have an hereditary nervous taint. Exciting causes may be any sort of reflex irritation, as eye defects, intestinal worms, adenoids, or phimosis. Great emotional disturbance, fright, anger, or overstrain, as from too much school work, may determine the onset.

The part played by acute rheumatic fever is of very great importance. The two are associated so very frequently, and similar heart lesions are caused by either of them in so many cases, that their close connection is a matter of daily observation. That a bacterial infection occurs in a great many cases of chorea cannot be doubted, and much evidence goes to show that the organism is the same as that causing rheumatic fever. But the certainty of any single organism being the cause of rheumatic fever is not yet definitely established, and still less certainty exists as to chorea. Reports of different observers as to the instance in which chorea and rheumatic fever occurred in the same person, at once or at different times, vary from 5 to 50 per cent. But as a general average it may be said that about 25 per cent. of cases of chorea and of rheumatic fever have or have had symptoms of both conditions.

Positive proof as to the etiological importance of the Diplococcus rheumaticus of Poynton and Paine must await our further investigation, but it has been very generally accepted.

Pathology.—There is no lesion of the central or peripheral nervous tissues characteristic of chorea. The heart lesions have been described under that heading.

Symptoms.—The attack nearly always develops gradually, with what appears to be simple clumsiness on the part of the child in making ordinary movements.

One of the commonest first symptoms is that the child drops and breaks dishes, and for this she is often wrongfully

punished. At this time it may be noticed that other things, as writing, sewing or other delicate work, are difficult and clumsily done. Soon there develop the irregular, jerky, spasmodic movements of the hands, or spasmodic working of the face muscles, or perhaps difficulty in walking. Generally the whole body becomes affected in the same way; in much less than half the cases these movements are limited to one side of the body. By this time the condition is unmistakable. The arms may be practically useless because of the rapid, involuntary jerking, the child being unable to dress or feed himself. Self-consciousness increases the movements, as when the child is asked questions and tries to answer. Efforts to repress the movements results in their increase. Sometimes they become constant, the child tossing about the bed, unable to eat or to sleep; in severe cases death comes without the child having been able to be still for an instant. If the child does go to sleep, the movement ceases. Speech is often slightly interfered with, and may be lost entirely. Children are sometimes brought to the physician with the statement that they are paralyzed, because of inability to use one arm or leg, and when the choreic movement was not enough to attract attention.

The mental condition is usually irritable and emotional. They laugh and cry very readily, and in severe cases a condition of maniacal excitement, which is very difficult to control, is seen.

The very frequent, serious involvement of the heart should never be forgotten in chorea, and the murmur of endocarditis should be frequently looked for. As these children are apt to be anemic, it follows that functional murmurs are fairly frequent, but the wisest plan is to treat every murmur developing in the course of, or after chorea, as an organic heart lesion. The involvement of the heart may not be prefaced by any noticeable fever.

A number of minor signs, as the rapid tremor of the fingers, an irregular contraction of the respiratory muscles in breathing, an increased knee-jerk with a characteristic "hang-up" of the foot, and certain peculiarities of the speech have been described as helpful in the diagnosis. Their value in the

diagnosis of certain cases is undoubted, but it takes a rather skilful observer to interpret them in the absence of more manifest signs.

Diagnosis.—After having once seen the rapid, purposeless movements of a typical case, it is difficult to mistake anything else for it. Habit spasm, and the athetosis sometimes following organic paralysis, rarely are similar enough to cause confusion. The neurotic temperament and the frequent poor nutrition are of some aid in the diagnosis. Usually the parent has made the diagnosis before the physician is called.

Prognosis.—Most cases perfectly recover as far as the nervous system is concerned. Recurrences are frequent. Cases of considerable severity should be closely watched, as fatal cases occur without involvement of the heart. The most guarded prognosis must be given in those cases developing endocarditis. This may be of any degree of severity.

The ordinary course is from six to eight weeks; not rarely from three to four months.

Treatment.—In every case the child should be taken from school and allowed no mental strain or excitement of any kind. Punishment of any sort is cruel and detrimental, although the necessity of keeping the child from play may seem like punishment. The diet should be exceptionally simple, nutritious, and free from any sort of stimulant, particularly tea and coffee. Complete rest for a certain time every day is best, and the cases with marked movements should be kept in bed until the acute symptoms have passed. The daily use of warm baths, combined with gentle massage, is of benefit.

If there is evidence or suspicion of a rheumatic infection, the salicylates should be used in large doses. This should be continued for four or five days, as much as 5 grains every two hours to a child of seven years. By this time it may be discontinued if it is evidently not effective. In other cases, particularly after the first few days, arsenic in the form of Fowler's solution often is of great benefit. Two drops should be given after meals, three times a day, to a child of seven years; the dose is increased a drop each day until the physiological limit is reached; then a dose should be given which

does not produce toxic symptoms but which is nearly up to the limit. After two weeks of the maximum dose it is wise to cut it down, or discontinue it for awhile, as rare cases of neuritis have occurred from its use. Iron should be given if the anemia is such as to indicate its use.

In cases where the spasmodic movements are extreme, and the child becomes exhausted and cannot sleep, bromides and chloral, or even morphin, must be used to control them and allow needed rest.

CHAPTER XIV.

DISEASES OF THE LYMPH GLANDS.

ACUTE ADENITIS.

Children are exceedingly subject to inflammation of the lymph glands in the neighborhood of any acute or chronically inflamed structure. This is particularly noticeable in the neck, from the frequent infections in the nose and throat. Some children are much more affected than others, and this tendency is often hereditary. Every time there is an infection of the throat, hands, arms, etc., the glands of the neck, groin or axilla swell and become tender. This enlargement often persists long after the infection itself has quite subsided.

Etiology.—The chief causes are acute infections of the nose, throat, mouth, and ears, scarlet fever, diphtheria, measles, and influenza. Glands elsewhere in the body respond to suppurative inflammation in the neighborhood, and the axillary glands to vaccination.

It is most frequent in the first two years of life, and in weak, undernourished children. It is very common in institutions. Often perfectly healthy children are quite prone to this condition.

Pathology.—The glands are swollen, edematous, and show active hyperplasia. From this stage all degrees are encountered to the entire destruction of the gland and the formation of one or more pockets of pus. If the infection subsides, the gland slowly returns to normal, or there is some permanent enlargement due to hyperplasia or increased connective tissue. The infecting organism is usually the strepto- or staphylococcus.

Symptoms.—With simple infection not due to the specific infections there is nearly always some fever, languor, loss of appetite, etc. The child complains of the neck, the glands are seen to be swollen, are tender and firm, and usually one

side is affected before the other; often only one side is affected at all. The usual locality in the neck is just below and behind the ear. There is nearly always some inflammation of the nose, mouth or throat, sometimes the ear. The throat or other symptoms subside, but the glands remain swollen or increase in size. After a few days more they begin to subside; or the evidence of inflammation increases, the skin becomes reddened, doughy, and edematous. During this time the constitutional symptoms may become severe, especially in a young infant. The tumor may grow to the size of a large plum, fluctuation is made out, showing the presence of pus. Even after marked symptoms, great swelling, pain and tenderness, the infection may subside and the gland fail to suppurate. If this is the case, the tumor may take months to entirely disappear. Occasionally the infection may spread from one set of glands to another and several abscesses result. In the suppurating cases the symptoms rapidly subside after proper opening and drainage.

Diagnosis.—During the very acute stage the symptoms may be so severe as to excite doubt whether the glandular swelling can be the cause. The age of the child, nearly always under two years, is important. The location is characteristic in the majority of cases. In the groin or axilla there is usually no difficulty.

The disease may be confounded with mumps when the swelling extends to the front of the ear, but close examination, with a careful history, should differentiate. Tuberculous adenitis is much more chronic, and usually a greater number of glands are affected

Prognosis.—When it complicates the exanthemata, this condition may militate against recovery. The other cases usually recover, but in debilitated children complete recovery may be a matter of weeks. Chronic adenitis may result.

Treatment.—In all the infectious diseases careful and frequent cleansing of the mouth, nose, and nasopharynx will do much toward preventing infection of the glands. Carious teeth, bad gums, and eczema of the scalp should receive appropriate treatment.

When the glands become infected, the probable cause should

be decided upon and treated, if it still exists. Often the inflammation subsides when the primary cause is removed. For the glands themselves either hot or cold applications should be used, whichever gives the greater relief. Nearly constant application of cold may have some effect toward preventing suppuration. Continuous moist heat certainly hastens pus formation, and usually relieves the pain decidedly. When it is evident that opening the pocket is necessary, it is best to wait until the glands are completely broken down before the abscess is incised, as recovery is more rapid and the necessary incision smaller.

CHRONIC ADENITIS.

Definition.—This is a chronic, non-suppurating inflammation of the lymph glands, neither tuberculous nor syphilitic, in which groups of glands anywhere in the body are much enlarged.

Etiology.—It is not nearly so common as the acute variety, but occurs much more often in children than in adults. It is often the result of one or more acute attacks. Chronic skin eruptions may be the cause. The teeth, gums, or tonsils are apt to be in bad condition. It is certain that some children have a decided tendency to chronic enlargement of these glands without very much apparent reason for it. It usually occurs under three years.

Pathology.—There is enlargement of the glands, with simple hyperplasia of the pulp and considerable increase in the connective tissue. They are usually discrete, not matted as in the tuberculous form.

Symptoms.—The striking symptom is the enlargement of several groups of glands; it is most common and most noticeable on the sides of the neck, both sides nearly always being affected. At intervals there may be attacks of pain and tenderness with some increase in the swelling. Generally there is neither pain nor tenderness. Softening and suppuration hardly ever occur. Usually the swelling slowly develops in the course of several weeks, and it is always many weeks or months before it subsides.

Diagnosis.—The important point is to differentiate from tuberculosis. Tuberculous adenitis is rare under three years; and the matting of several glands, such as is common in tuberculosis, never occurs here. The finding of some local cause of infection is of value and is nearly always possible. The course is more rapid, and improvement nearly always follows the elimination of the cause. The tuberculin test should be used in doubtful cases.

Prognosis.—It is never fatal, and there are no serious results of any sort. The swelling nearly always subsides in a few months.

Treatment.—This consists entirely in removing any possible cause of the infection, and endeavoring to improve the child's general condition. Iron and cod-liver oil, with generous diet and plenty of fresh air will hasten the recovery.

TUBERCULOUS ADENITIS.

Definition.—This is an infection of the lymph glands by the tubercle bacillus. It forms a part of the condition that was formerly called scrofula. Under this heading is included only the infection of the external lymph glands.

Etiology.—The infection is rarely seen in infants; it is very common from three to eight years. (This is remarkable when one considers the great frequency of infection of the bronchial glands in infancy.) The great majority of cases are in the glands of the neck. Conditions responsible for it are enlarged tonsils and adenoids, chronic disease of the throat, bad gums and teeth. Those children who readily present simple enlargement of the glands are prone to develop the tuberculous form; those with a tuberculous family history are readily susceptible. Not rarely it follows the acute adenitis of measles, scarlet fever, and occasionally other infectious diseases.

Pathology.—The deep cervical glands are nearly always affected; they may be alone involved. In most cases no other glands than the cervical are affected. Any or all of the groups may show it; the deep cervical, pre-auricular, parotid,

submaxillary, submental. A chain of them sometimes runs down to or below the clavicle.

According to the length of time and the severity, the glands are either firm, fibrous, the capsule thickened, and the separate glands fairly discrete; or they are soft, some broken down, there is much exudation in the surrounding tissue, and the separate glands are matted together and fused with the surrounding tissues. Tubercle bacilli can always be demonstrated in both varieties.

The first form is essentially chronic. The glands enlarge slowly without pain or tenderness; they may increase in size for many months. In the second form the growth is more rapid and the breaking down eventually causes abscesses in the cellular tissue.

Symptoms.—The only noticeable sign is the slow enlargement of the glands, usually in the neck but possibly in any location, the axilla, groin, etc. Nearly always more than one group is affected. The matting and immovability of the separate glands is a valuable point. There is no pain, tenderness, nor evidence of inflammation. The general health does not suffer unless some more active process is at work. In many cases the cellular tissue becomes firm, resistant, here and there a soft area, and later slight reddening and fluctuation; it may be long before the skin is ruptured and the pus evacuated. There is then left a discharging sinus which may last interminably. Irregular, ugly scars are often the result.

The course of the disease may extend over several years; always it is many months. Not infrequently the process subsides, the swelling lessens slowly, and complete recovery takes place without any abscess formation.

Diagnosis.—This is usually easy with a good history or prolonged observation. The tuberculin test should be performed. Excision and inoculation to discover the tubercle bacillus is certain.

Usually the location, the age of the child, the matting of the glands, and the lack of evident cause, will make the diagnosis. Hodgkin's disease will sometimes confuse. This nearly always involves many groups in different parts of the

body, there is no matting or softening, and there is soon evidence of serious illness. With the formation of abscesses tuberculosis is nearly certain.

Prognosis.—This is very different from that of tuberculosis elsewhere. These children not only do not die of the gland lesions but they are not often seriously affected with tuberculosis of other parts. That they may develop acute tuberculosis after many years makes the outlook rather poor. Most of the gland lesions disappear, either by absorption or by rupture and healing.

Treatment. The main points in treatment are the cure of any disease of the teeth, tonsils, adenoids, nose, etc., and the proper attention to the child's general welfare. Although of secondary importance, the use of cod-liver oil and some form of iron, or iron and arsenic, is really beneficial.

If, after faithful trial of the above measures, the swelling increases or evidence of softening appears, operation should be considered. This means resection of as many as possible of the affected glands. It obviates the formation of the very large, ugly scars used by spontaneous rupture, shortens the process, and may prevent subsequent infection of other parts of the body.

HODGKIN'S DISEASE.

(Pseudoleukemia.)

Definition.—This is a condition of tremendous hyperplasia of the lymphatic glands in many parts of the body, associated with progressive anemia, and it is probably always fatal. It is apparently closely related to the so-called splenic anemia, or Banti's disease, but modern writers generally incline to the belief that they are quite separate diseases.

Etiology.—It is a rare disease, and exceedingly rare in childhood; males are more often affected than females. Recently there has been described, independently by different investigators, a diphtheroid bacillus of characteristic morphology and cultural peculiarities, grown from the glands of several cases. The observations have been so accurate and uniform that they sound impressive. No other causative factor is known.

Pathology.—The characteristic lesions are in the lymph glands and the growth of lymphoid tissue in the spleen and liver, and to some extent in other organs. There is a marked increase in the lymphoid tissue and a proliferation of the endothelial cells; the great number of eosinophile cells in the glands and spleen is characteristic, with giant cells and decided fibrosis.

The enlargement of the glands may be tremendous, in the neck, axilla, groin, mediastinum, abdomen, in fact, anywhere in the body. The spleen is usually enlarged, the liver occasionally.

Symptoms.—The onset is very gradual, the first sign being the progressive enlargement of the glands, usually of the neck. With this there is always more or less anemia, and this may be the first thing to excite remark. Rarely the first symptom may refer to pressure of masses of internal glands, causing cough, dyspnea, edema of the legs and abdomen, etc.

After considerable time the constitutional symptoms appear.

These are anemia and its results; pallor, weakness, occasional fever, signs of pressure in the throat, chest, or abdomen. Death occurs from exhaustion, from pressure on some vital organ, or from some intercurrent infection. The usual duration is two or three years.

FIG. 23. — Hodgkin's disease. Showing tremendous enlargement of spleen and lymph glands. (St. Louis Children's Hospital.)

Prognosis.—Probably every case is fatal. Reports of decided improvement have followed the use of *x*-rays, and also the use of the vaccine prepared from the diphtheroid bacillus, but final reports are yet to come of permanent cure.

Treatment. As far as is known there is no cure, nor anything that will often have any effect. The use of the *x*-rays is certainly indicated because of the occasional marked improvement. The use of vaccines depends upon our further knowledge.

Rest, general tonic treatment, preferably with arsenic, will delay the outcome to a certain extent.

STATUS LYMPHATICUS.

(Lymphatism.)

Definition.—This is an abnormality of the lymphoid structures of the entire body. There is a simple enlargement of the glands and of the follicles of the intestines, and a striking enlargement of the thymus gland; this is the important lesion.

Etiology. The cause is quite obscure. There is quite possibly some connection between this condition and the tendency to chronic enlargement of the lymph glands seen in certain children often with an hereditary basis. It is not a common condition, is seen practically only in childhood, and is much most frequent from the sixth to the twelfth month. It is observed at times associated with rickets, but rickets is such a frequent disease that it is hardly likely that status lymphaticus is a result of it.

Pathology.—There is a simple hyperplasia of the lymph glands all over the body, external and internal; of Peyer's patches and solitary follicles in the intestines; of the pulp of the spleen.

Most characteristic is the enlargement of the thymus gland. The function of this gland is unknown, and in this disease no symptoms can be attributed to it other than those caused by pressure on the surrounding parts, particularly the trachea. Normally the gland weighs about 6 grams at birth, decreasing slightly in size and weight until the tenth or twelfth year, when it undergoes complete atrophy. Some variation occurs normally, but it is assumed to be pathological when it weighs more than 10 grams. In the state of lymphatism it may weigh 30 to 40 grams. There is no change in the gland other than the hyperplasia.

Symptoms.—The only symptoms are attacks of dyspnea or complete asphyxia (which may result in sudden death) and recurring general convulsions. Unexplained sudden death in apparently healthy infants or children is often due to a much enlarged thymus. This is generally precipitated by some acute illness of any sort, particularly of the respiratory tract, sudden severe fright, or the administration of an anesthetic; the latter is a particularly unfortunate accident which usually could not have been foreseen.

Sometimes the condition manifests itself in convulsions, or in attacks of dyspnea without any exciting cause. Death may occur in either manifestation, but convulsions usually occur before death from the asphyxia.

In a child subject to such attacks the diagnosis can never be positively made except postmortem, so in any but the fatal cases the diagnosis is always in doubt.

Other children never give signs of thymic enlargement, but seem to be extremely subject to severe illness with simple diseases; after succumbing in rather a surprising manner to a comparatively slight illness the postmortem examination shows the very large thymus. In these cases it is assumed that the lymphatism manifested itself in a greatly lessened stamina.

Diagnosis.—This is always uncertain. The striking symptoms are those related to the thymus, but enlargement of the gland is extremely difficult to determine by percussion. When it is very large, it presents a triangular dulness to the right and still more to the left of the manubrium sterni; the base of the triangle is above and the apex below. Usually the condition can only be surmised.

Prognosis.—The diagnosis being so difficult beforehand, it is manifest that the prognosis cannot be very definite. It is sure that it lessens the resistance to other diseases, and often determines a fatal result in a moderate illness. Weak, delicate children with demonstrably enlarged lymph glands, should be carefully watched during anesthesia, or sudden pain and fright, as in giving antitoxin, performing lumbar puncture, etc.

There is no *treatment* for the condition.

CHAPTER XV.

DISEASES OF THE EAR.

ACUTE OTITIS MEDIA.

Inflammations of the middle ear, both suppurative and catarrhal, are exceedingly common in infancy and childhood.

Etiology.—It is usually secondary to inflammation in the nasopharynx. This may be a simple rhinopharyngitis, such as is called a "cold in the head," adenoids, inflammation of the tonsils, or the pharyngitis that occurs in the course of certain infectious diseases. Of these the commonest are scarlet fever, influenza, and measles; less often pneumonia and diphtheria. Occasionally it occurs without ascertainable cause. The staphylococcus, streptococcus and pneumococcus, and the influenza and diphtheria bacilli have been shown in the discharge.

Pathology.—The course of the infection is through the Eustachian tube to the middle ear, causing a swelling and perhaps complete occlusion of the tube. It may be confined to the tube or spread to the middle ear. Here it causes either a catarrhal inflammation, with a serous and mucous secretion, or an active suppuration with the production of pus. The former is common in infants; the latter much more frequent in older children. In the suppurative variety necrosis takes place, perhaps only of the drum membrane, but often of the ossicles. The entire tympanic cavity may be affected and the mastoid cells be involved.

Symptoms.—This is one condition that is probably overlooked in infants as frequently as any other, owing to the extreme obscurity of the symptoms and the concealed anatomy of the part involved. There are no symptoms except fever and pain, until the discharge appears, if it does appear. Nearly always there is evidence of the inflammation of the throat, or the existence of some infection. In the course of the disease suddenly the temperature rises in a way

that the original disease does not account for, the fever is from 101° to 103° F., often higher, even sometimes 105° or 106° F. An infant may seem to be seriously ill, and of course there is no way of interpreting the symptoms as due to an otitis, as the child does not direct attention to it. An older child usually complains of pain in the ear, and the diagnosis is then readily made by examination. Occasionally the fever will continue several days before any special complaint is made.

The pain is nearly constant, and an infant will often cry continuously. Pulling the ear, or often pressure in front of or behind it, will increase the pain.

In the catarrhal form none of the symptoms are so severe, and the condition subsides in two or three days; the pain is not so constant and relief easier to obtain. In the purulent form the symptoms continue, and perhaps increase, until the membrane is incised or ruptured, when relief is at once manifest. The discharge of pus is profuse at first, and usually continues for many days or weeks. In this form also a mastoid abscess is apt to form, and occasionally a septic thrombosis of the lateral sinus, localized meningitis, or dural abscess develops. From the infection of the lateral sinus systemic infection, general meningitis, etc., may result.

With cases of moderate or marked severity there may be loss of appetite, headache, all the evidences of severe febrile disease, even delirium and great prostration. The leukocytes are always considerably increased in the purulent form, as in any variety of pus formation.

Diagnosis.—Fever of unknown origin, combined with evidence of pain or tenderness about the ear, usually will impel one to examine the ears and discover the inflammation. The only positive means of making the diagnosis is to examine the ear drum. And one who does not do this as a routine measure in every case of obscure fever is sure to be greeted more than once with the mother's statement that the ear is discharging, and the child quite comfortable, without his having suspected that there was anything the matter with the ear. The diagnosis is made by seeing a reddened ear drum, and if there is bulging of the membrane, there is probably pus behind it.

Prognosis.—In the catarrhal form the outlook for recovery without impairment of hearing is good. In the purulent form there may result partial or complete deafness in the affected ear, depending on the amount of actual destruction; many cases recover without any impairment whatever, the drum membrane growing over the defect. The most severe cases are apt to follow scarlet fever. Many of the complications are very serious. One complication that is rather remarkable, and not infrequent, is a hemorrhagic nephritis. This may develop during suppurative otitis following measles, influenza, or even following a simple pharyngitis. It usually clears up promptly with proper treatment.

Treatment.—A great many cases of this infection can be forestalled by removal of adenoids when they are the seat of continual infection. Also proper care of the nose and throat in any mild infection, and during the course of the acute infectious diseases. The use of strong applications or solutions is not advisable.

The *medical treatment* consists in the relief of pain and, if possible, control of the inflammation. The application of dry heat is sometimes effective, or syringing the canal with salt solution as hot as can be borne. The use of warm 5 per cent. carbolic acid solution, or even 10 per cent. in water and glycerin, sometimes affords prompt relief. Careful but thorough syringing of the throat occasionally stops the inflammation in the ear. Cocain in 4 per cent. solution may be used in the ear, but usually will do little good if the carbolic acid does not help. If the pain is still not controlled, morphin or opium, in suitable amount, must be given.

General measures include free catharsis in the beginning, the diet should be light and moderate, and the child kept in a room with equable temperature and protected from draughts.

If the membrane is found tense and bulging, the drum should be lanced freely; better drainage is procured than if the rupture is spontaneous, and the relief of the symptoms is immediate. Sometimes this measure will cause the subsidence of infection of the mastoid, and it should always be performed at once if the mastoid is seen to be involved.

Operation on the mastoid cells for infection in that locality

is a matter of grave concern, and should be performed only when it is evident that no other means will control it.

The after-treatment of the discharging ear consists in keeping the canal scrupulously clean. If the discharge suddenly ceases, the ear should be examined to see if the opening is stopped up.

CHRONIC OTITIS MEDIA.

Chronic otitis occasionally follows severe or repeated attacks of the acute purulent form. It is generally due to neglect during the acute attack. Tuberculosis and syphilis are rather frequent causes.

There is a constant purulent discharge from the middle ear, partial or complete destruction of the drum, and often considerable destruction of the normal middle-ear contents, with partial or complete deafness. Generally there is also a secondary inflammation of the external ear and often an eczematous inflammation of the skin in the neighborhood.

Symptoms.—The main symptom is the discharge, which may be free and noticeably purulent, or sanious and foul-smelling. It is usually quite irritating. Examination will show the injury to the middle ear and the auditory canal. Occasionally the lymph glands in the neck are swollen and tender.

Prognosis.—The condition is often an extremely protracted one, and adults not infrequently are found suffering from this condition which they have had since childhood. Persistent treatment will effect much, but this can only be intelligently done by a specialist in that line.

Treatment.—Because of the possibility of the presence of necrotic bone, of polyps, and excessive granulations, these cases are much best treated by an otologist. The treatment that is available to the general practitioner consists in careful syringing with some mild antiseptic solution and keeping the canal as clean as possible, and the external parts protected from the discharge. Peroxide of hydrogen is often useful.

Any abnormal condition in the nasopharynx should be attended to, and the child's general health kept as good as possible.

CHAPTER XVI.

DISEASES OF THE SKIN.

ICHTHYOSIS.

This is an abnormal condition of the skin, usually congenital, characterized by the formation of scales over much or all of the body surface; it is well named "fish skin."

Etiology.—The condition is hereditary, as its occurrence has been noted frequently in families. Little else is known of it, but conditions similar have been noted with absence or deficiency of the thyroid gland, and it is possible that some cases considered as ichthyosis may be in fact due to hypothyroidism.

Pathology.—It is now generally considered that the condition is rather an inherited deformity of the skin than a disease, and this deformity consists in a thickening of the epidermis due to the formation of scales. The glands of the skin are unchanged in some cases, but their activity is lessened. Often there is decided gland degeneration.

Symptoms.—Almost any degree of scaliness may be met with in cases of varying severity. In the condition commonly called ichthyosis congenita the scaliness is evident at birth and may be so severe that the entire cutaneous surface is roughened, hard, with many folds and fissures at the various flexures; the latter sometimes bleed and become very painful. The auditory meatus and the nostrils may be occluded by the excessive proliferation. When the condition is so extreme, the child usually lives only a few days; others less affected live without the disease causing any appreciable harm.

In the more common form, ichthyosis simplex, the condition is usually not noticed until the end of the first or second year. Then there is seen a gradually increasing scaliness, most evident on the extensor surfaces of the arms and legs,

elbows and knees, and the back. With this there is decided lessening of perspiration. It is nearly always much worse in winter, perhaps disappearing entirely in the summer.

The severe cases, which survive, are frequently exhibited as freaks, being called fish- or alligator-boys.

Prognosis.—In severe congenital ichthyosis the outlook is not good, as the function of the skin is almost entirely destroyed as far as elimination is concerned; some severe cases live for many years. Simple ichthyosis is incurable but is compatible with long life.

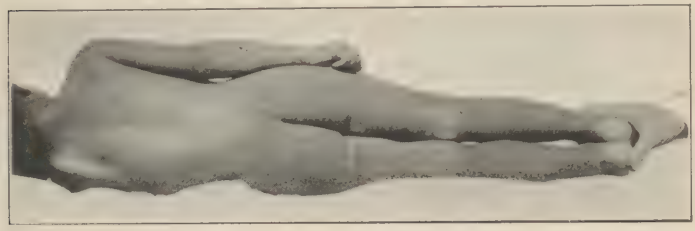


FIG. 24.—Ichthyosis simplex of moderate degree. (Barnard Free Skin and Cancer Hospital, St. Louis.)

Treatment.—A great many remedies have been used with reported good results, but no two people seem to be able to agree on the same one. The only exception to this is thyroid extract; good results in a number of the milder cases have been observed by different men. The results are temporary, and seem to confirm the belief that at least some of these cases are due to hypothyroidism.

Of much more importance are external applications, and of these the necessary item is the warm bath. A bath should be given every day, warm enough and prolonged enough to induce free perspiration. After this the skin should be rubbed with oil or vaseline to soften and remove the scales. The scales may sometimes be softened and loosened by 2 per cent. salicylic acid in cotton-seed oil. It is of the utmost importance to do this methodically and regularly with a young child, as by this means the severity of the condition may be

lessened throughout life. After the type becomes confirmed in the youth or adult there is usually no change in the character of the disease.

SEBORRHEA.

There is considerable difficulty in separating simple seborrhea from the same condition associated with more or less eczema. But in general seborrhea is characterized by a formation of thick, oily crusts on the scalp.

FIG. 25.—Severe seborrhea of scalp. (Barnard Free Skin and Cancer Hospital, St. Louis.)

Etiology.— It is a common condition in infants, becoming less frequent as the age increases. The actual cause is the excessive secretion of the sebaceous glands. If the scalp is not properly cleansed, the oily secretion dries and, with the mixture of dirt, causes thick, dirty scales that are firmly adherent.

Symptoms.—Usually the vertex of the head presents a large patch of dirty, yellowish, greasy secretion. Various

areas are affected in the same way, and almost the entire scalp is sometimes covered with this thick crust, presenting a picture of pitiable neglect. The hair is oily, often sticky, and apt to be matted in tight strands or bunches. Itching is rarely present, unless secondary inflammation results. The skin is normal under the patches, but neglected cases of long standing nearly always show an accompanying eczema with the characteristic skin changes.

Treatment.—It is important to begin treatment as soon as the condition is discovered, because of the liability of the development of eczema. First the crusts must be softened by means of continuous application of oil or vaseline for twelve to twenty-four hours. Vigorous washing with soap and warm water will remove the crusts. If one oiling and washing is not sufficient, it is repeated until the scalp is clean. The scalp is then treated with 3 to 6 per cent. sulphur and 2 per cent. resorcin in vaseline; this is discontinued after a few days and used again as the condition indicates. Usually intermittent treatment is necessary for a month or more.

MILIARIA.

This is commonly called prickly heat, and is a very common condition in childhood. Different varieties are described, but as they differ only in the predominance of one or another lesion in the general eruption, the varieties are of little importance.

Etiology.—Excessive heat, with the production of excessive perspiration, are the two items of greatest importance.

Pathology.—The lesions are due to obstruction of the sweat glands, with mild inflammatory reaction; whether the obstruction or the inflammation appears first is undecided. The lesions consist of pearl-like vesicles (sudamina) if the inflammation is very slight; or of small red papules with marked red areolæ about them (miliaria rubra); or the latter may become pustular, with the formation of tiny pustules.

Symptoms.—Usually all three of the lesions are present to a certain extent, one of them predominating; the pustular

is the least common. Most often it appears as a diffuse red rash, most commonly on the neck, armpits, back, abdomen, less often on the forehead. Only when the papules are rather large and closely set together is it apt to be very irritating. Then the itching may be extreme and associated with intolerable burning and smarting. Sudamina and the simple miliaria rubra may cause little or no discomfort.

Treatment.—During hot weather the child should be lightly dressed with cotton next the skin; it should be bathed frequently in cool water and the skin kept dusted with some non-irritating absorbent powder; equal parts of zinc oxide, boric acid, talc and starch make a very effective powder.

These measures are also indicated when the eruption is present. It is best to curtail the diet somewhat and see that the bowels move effectively. The application of a soothing lotion is valuable, and of these nothing is better than zinc and calamine lotion—zinc oxide, 1 oz.; calamine, ½ oz.; glycerin, 1 oz.; liquor calcis, q. s. ad 8 oz. This should be applied freely two or three times a day; if there is any tendency to pustulation, 1 per cent. carbolic acid may be added. Under this or similar treatment the case should recover in a few days.

FURUNCULOSIS.

The furuncle, or boil, is a deep-seated pustular inflammation of the skin, and the condition of furunculosis is one in which there are numbers of small boils appearing at the same time.

Etiology.—The infection is due to the entrance of the pus organism into a hair follicle or sebaceous gland, probably always the staphylococcus. Pus from one boil will infect another gland or follicle and in this way successive crops are formed. They are much more common in infants than in older children, and are much more common in the poorly nourished than in the robust.

Symptoms.—The boil as it is seen in young children does not present the great swelling, induration, diffuse redness

and great pain that are so characteristic of them in adults. It begins as a small red papule, and a small area of the surrounding skin quickly becomes indurated and tender and forms rather a sharp elevation. Within a couple of days fluctuation is evident, and if it is then opened, the pus readily flows out without the well-known "core" of the adult boil. During the stage of formation the area is very tender, but this is not pronounced when fluctuation is apparent. When the pus is evacuated, after three or four days usually, the cavity rapidly fills with granulation tissue and healing takes place in a few days.

There may be great numbers of these furuncles, from a dozen to a hundred, and they may keep on forming in a very distressing way. The favorite sites are the scalp, face, shoulders and arms; they may occur anywhere on the skin. When there are many of them, they usually vary considerably in size, a few being as large as a hazel nut, but most of them about the size of a pea.

Treatment.—It is usually necessary to direct attention to the proper care and feeding of the child, and endeavor to improve the general condition by some tonic treatment. Cleanliness of the skin is essential. The treatment of the individual boils demands protection and incision, the latter only when the abscess is ready to point. After opening it is dressed with a small, dry dressing which is not removed until the cut is healed. The use of wet applications at any stage is rather risky, as it sometimes seems as though the boils are spread in this manner.

If there are a great many boils, or if successive crops continue to appear, the most effective treatment is the use of staphylococcus vaccines.

The ordinary stock vaccines seem as effective as the autogenous in most cases, perhaps in all. The dose is one hundred million, injected every four days, and increased to two or three hundred million if it seems necessary. Inasmuch as the procedure is a harmless one, it seems advisable to use it in every case, and prevent the possibility of a succession of boils. In no other condition is the value of the use of vaccines so strikingly demonstrated.

IMPETIGO CONTAGIOSA.

This is a purulent infection of the skin in which there are superficial vesicles or blebs which soon become pustular, and later form thin yellowish crusts.

Etiology.—The disease is very common in children, is contagious, and hence is often seen in a number in the same family, among the poor who occupy crowded quarters, and in places where children come in close contact, as the public playgrounds and, particularly, public municipal swimming pools. The organism is probably the Staphylococcus aureus, although the French observers offer considerable evidence that it is a streptococcus of low virulence.

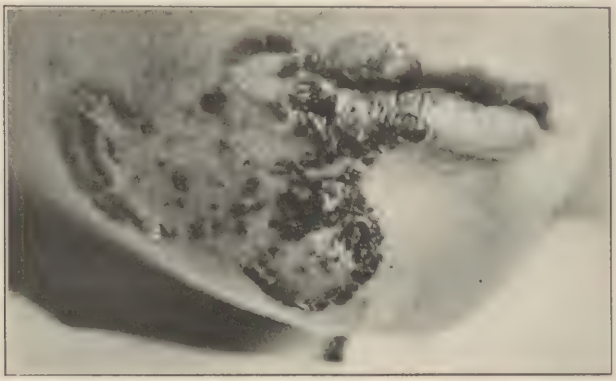


FIG. 26.—Impetigo contagiosa of moderate degree. (Barnard Free Skin and Cancer Hospital, St. Louis.)

Symptoms.—Occasionally there is slight fever and malaise with the outbreak of the eruption. More often nothing is noted except the eruption itself. This begins as isolated vesicles, the contents of which very soon become purulent. The vesicle, or pustule, spreads until it forms a flat bleb which soon dries, leaving a thin, yellow crust; when the crust falls off, the skin beneath is seen to be red, but there is no depression or scar. The most common site is the face, particularly near the mouth, next the neck and limbs, less often the scalp.

Good evidence of the auto-inoculability of the disease is the fact that it is rarely, if ever, seen on the back, and not often on the abdomen.

The duration is about two to four weeks, but neglect, irritation, scratching, etc., may produce sores that take many weeks to heal. Large areas may be affected by the coalescence of two or more blebs. Fresh crops through auto-inoculation may prolong the disease indefinitely.

Diagnosis.—Chicken-pox, and rarely pemphigus, are the only conditions likely to be confounded with it. The size of the lesions, their superficial character, and the absence of the areola, and particularly the location of the lesions, are the points of differentiation; of importance also is the ease with which the disease is controlled.

Treatment.—The crusts must be first removed, either by washing alone, or first softening with oil or vaseline. Then the application of 3 per cent. xeroform in vaseline, or 5 per cent. white precipitate ointment usually effects a cure. If ulcers have formed from scratching or other injury, a wet bichloride dressing should be applied, followed by the use of an antiseptic powder when they are quite clean.

ECZEMA.

Definition.—This is a very common inflammatory affection of the skin, characterized by thickening and exudation, redness and crusting, with a great variety of secondary lesions, and usually accompanied by itching, either moderate or severe. It may be acute or chronic, confined to a small area or cover almost the entire body, and presents a great variety of different forms.

Etiology.—Infants are extremely prone to develop eczema, and its manifestations are fairly uniform. The eczema of older children does not differ materially from that of adults and is not specially considered here.

Certain infants have a decided tendency to develop eczema, due either to some peculiarity of the skin or to an inherited tendency, perhaps of imperfect digestion, assimilation, or hyperirritability of the skin. Such children are often the

victims of large tonsils and adenoids, subject to frequent attacks of bronchitis, intestinal indigestion, develop intertrigo at the cutaneous folds, in fact, show the various peculiarities that Czerny has described as the exudative diathesis.

The commonest form, the red, weeping, facial eczema, is most often seen in fat, well-fed or overfed children, no matter what sort of food they have had. But that a great many of them are unable to properly digest the amount of fat they are taking is undoubtedly true. This form does not often occur in poorly nourished children. Other causes, perhaps secondary, are uncleanliness, irritation from exposure, clothing, nasal discharges, irritation from urine and feces, and from the use of strong soap. The importance of imperfect digestion and elimination is paramount. For this reason it is more common in bottle-fed than breast-fed babies. It is frequently observed in constipated babies, especially when the constipation is due to too much fat. Improper articles of diet of almost any sort may cause an eczematous eruption in a susceptible child, particularly beginning solid food too early, or in too large amounts. In general, overfeeding or improper feeding of any sort will produce eczema in a susceptible infant. The attacks of eczema that occur during teething or any other condition causing unusual irritation are doubtless due to the effect of the irritation on the digestion, and so act indirectly on the skin.

Other skin irritations, as seborrhea, scabies, pediculi, etc., frequently are the cause of eczema.

Pathology.—Eczema is a catarrhal inflammation of the skin. There is an edema and infiltration of the epidermis and corium with a definite thickening of the skin. The peculiar, sticky exudation which is characteristic of the disease is made up partly of this exudation and partly of the fluid resulting from the cellular degeneration. This, when dry, gives the gummy, yellowish, glazed crust that is so often seen in eczema.

Symptoms.—The appearance of a child with the common facial eczema of moderate degree is quite typical. Particularly on the cheeks there is a diffuse, shiny redness due to erythema, many vesicles and papules, and the glazed

crusts that adhere very firmly to the skin. The skin is thickened and feels firm and indurated. Here and there, particularly where the crusts have been loosened, is seen the limpid, sticky fluid that exudes from the skin and is so typical of eczema. Bleeding is often caused by the scratching due to the very severe itching; the blood is incorporated in the crusts and gives them a dirty brown color. After the cheeks the most common sites are the forehead, scalp, ears and the folds behind the ears, the external genitals and

Fig. 27.—Severe facial eczema. (Barnard Free Skin and Cancer Hospital, St. Louis.)

the buttocks. In very severe cases a most the entire face may be covered with the crusts and the child be in a veritable torment from the intolerable itching. The patches may appear on any part of the body, but there is rarely very large involvement of other parts. In some cases, particularly babies in poor general condition, the disease is so wide-spread as to receive the name "eczema universale."

When the lesions become infected and form small pustules, the condition is called pustular eczema. This is quite

common, and occurs most often on the scalp; with it there is sometimes found pediculosis capitis. The crusts formed are softer, more oily, and may be very thick. Curiously enough, this form is not apt to itch to a great extent, though almost the whole scalp may be covered by the crusts.

In severe eczema there is nearly always considerable enlargement of the neighboring lymph glands; this is quite constant and noticeable in the pustular form. Not rarely the glands suppurate and form abscesses.

Very commonly there is a softening and exfoliation of the skin with the production of opposing raw or erythematous areas in the folds of skin at the groin, elbow, external genitals, etc. It may consist only of a moist erythema. The descriptive name of intertrigo has been given to this condition, but it is probably an eczematous manifestation.

Babies with eczema do not usually give any evidence of illness but are nearly always restless, fretful, sleep poorly, and seem miserable in general. This is largely due, of course, to the severe itching. But they may continue to gain in weight nevertheless.

Diagnosis.—Infantile eczema is usually quite distinctive. The danger is, on account of the prevalence of the condition and the familiarity of the laity with the term, to call any facial eruption eczema. Congenital syphilis and scabies are most apt to be confounded when the disease is present on parts other than the face. Syphilis, in particular, may be very difficult to differentiate by means of the appearance alone; but the fact that it does not itch, shows no definite thickening of the skin, is usually discrete, and most common on the face, forearms and hands, legs and soles, and usually has a characteristic copper color, should serve to place it. Scabies produces itching that may be extreme, but it is usually present on the naturally moist surfaces, as the webs of the fingers, flexures of wrists and elbows, axillæ, and about the genitals. Other members of the family are generally affected and careful inspection may locate the minute burrows.

One should remember that the characteristics of eczema are the multiform lesions, "weeping," crusting, itching, and the definite thickening of the skin.

Prognosis.—This is a tedious condition, remarkably subject to recurrences after the skin has cleared. In the mild or early stage nearly every case can be much improved or entirely cleared up; but the regularity with which it returns is a trying tendency. Very severe cases will try the patience of all concerned because of the chronicity.

Treatment.—In practically every case there is some cause for the appearance of the eczema, either in external irritation, irritating discharges, improper food, or imperfect digestion. Every effort should be made to discover and correct any such cause, and the child's life regulated according to the most improved hygienic rules. Special attention should be paid to the diet and the condition of the stomach and intestines, urine, stools, etc. Intelligent coöperation on the part of the mother or nurse is essential, and all directions should be very explicit.

During the acute stage no soap or water should be applied to the inflamed surfaces; cleansing can be done with a soft cloth and some bland oil, allowing the oil to remain on a few minutes and then mopping as dry as possible. If the crusts are thick and firmly adherent, washing is necessary until they are removed; this is best done after prolonged soaking with olive oil, or olive oil and hydrogen peroxide equal parts. If they are very hard and thick, a flax-seed or other poultice may be used first. When the skin is free from crusts, the use of a sedative ointment is necessary during the acute stage, and the skin should be protected by it most of the time—and always when the baby is in the open air. Of these, nothing is better than firm Lassar's paste. During this stage the itching may be intense, and this may be considerably relieved by a suitable sedative lotion, as follows:

℞—Pulv. calaminæ . . . . . ʒiv
Zinci oxidi . . . . . ʒvj
Liquoris carbonis detergens . . . . . ʒiv to vj
Glycerini . . . . . ʒj
Aquæ rosæ . . . . . q. s. ad ʒviij
M. Sig.—Apply frequently and allow to dry.

After the acute stage the most useful applications are the stimulating ointments containing tar in some form. It is

best to begin with a small percentage of tar and gradually increase the strength as no irritation is produced. A good one to begin with is ungt. picis liquidæ, dr. ½, and ungt. zinc. oxid, oz. 1. The strength can be increased as indicated. Lassar's paste, with 5 to 10 grains of salicylic acid to the ounce, is useful at this stage.

In the various text-books on dermatology will be found innumerable formulæ for the various stages, illustrating the difficulty experienced in treating each individual case. It is advisable to emphasize the fact that, while external treatment is valuable and necessary, the important measures are to find the cause, arrange the child's life so as to assure it the greatest comfort, cleanliness and health, and keep the skin constantly from exposure by the use of soothing applications. All applications should be kept on the inflamed surfaces as constantly as possible.

URTICARIA.

Urticaria is another very frequent disease of early life. It is commonly called hives, or nettle rash. In young children it differs from the same disease in later life in the frequency with which the lesions are vesicular, papular, or even pustular, usually in connection with the familiar wheals. Not rarely there are many patches of erythema. Urticaria is characterized by sudden appearance and disappearance of the lesions, and by the frequent association of gastro-intestinal disturbance.

Etiology.—Most frequently the cause is some acute disturbance of the intestinal tract, particularly from the ingestion of some quite unsuitable food. In different children tomatoes, strawberries, oatmeal, eggs or fish-food will produce an attack as surely as they are taken. Certain medicines, particularly quinine, will cause it in susceptible individuals. Diphtheria antitoxin or antimeningococcus serum sometimes cause such an eruption. The horse serum occasionally produces a very intense form, known as giant urticaria, or angioneurotic edema, in which the lips, face, hands, and other parts may be swollen tremendously.

Symptoms.—The typical lesion is the wheal. This is an irregular patch, slightly raised, usually paler than the surrounding skin but sometimes a light pink. They itch, sometimes intensely, and are apt to appear and disappear in different areas in a few hours. Often the wheals soon give place to small papules, which may be the only lesions seen at the time of examination. These are small, red, show the effects of scratching, and are most often seen on the forearms and legs, hands and feet. This appearance has given the name of lichen urticatus to the condition, though it is really a papular urticaria.

In the beginning of an attack there may be slight fever, malaise, and often evidence of some gastro-intestinal irritation. Then the wheals appear, and they vary in size from a dime to a dollar, rarely larger. The papules usually do not appear to a great extent before the second day, and may not be present at all. Itching is practically always present and may be extreme.

Diagnosis.—Scabies is the only condition likely to be confounded, and then only when the lesions are papular. Often the history is the only means of differentiation.

Treatment.—In every case it is wise to at once give some effective cathartic, preferably calomel or castor oil. The dietary indiscretion should be discovered if possible. In the more protracted cases it may be necessary to rearrange the entire feeding, for that is usually at fault. If on a fairly general diet, the child should be put for a time on a milk diet, and the later feeding carefully regulated.

Locally a warm alkaline bath will sometimes relieve the itching. Calamine lotion, with 2 grains of menthol to the ounce, is often effective, as is 1 per cent. carbolic acid. Severe, prolonged cases of papular urticaria are sometimes extremely intractable and require the utmost care as to diet, manner of life, etc.

Atropin in gradually ascending doses has given excellent results in some cases.

Recently a series of experiments has been carried out to show that the disease is often a manifestation of a susceptibility to certain proteins. Vaccination with dilute solutions

of the proteins, egg, casein, meat, etc., show in some cases a reaction to one protein and not to others. The claim is made that when this reaction is obtained the child can be immunized by giving minute and increasing doses of the food. This is as yet experimental.

SCABIES.

This is commonly known as the itch. It is characterized by moderate contagiousness and severe itching.

Etiology.—It is due to the boring under the skin of the acarus scabiei. Only the female invades the tissues, and it lays its eggs and subsequently the eggs hatch and the new generations prolong the disease.

Symptoms.—The condition is ushered in by itching of the skin. This is most apt to be noticed just after the child has gone to bed and become thoroughly warmed. The parts most often affected early are the webs of the fingers, the wrists, elbows, axillæ, lower abdomen and about the genitals and anus. Later considerable of the body surface may be affected. Infants may show initial involvement of the face, acquiring the infection from the skin of the mother's breast. The lesions are small papules, with fewer vesicles, and often pustules; always there are the scratch-marks due to the itching. Most characteristic is the small papule with the top scratched off and replaced by a tiny scab. The burrow is so rarely found that it can hardly be said to be evidence of the disease; it is a tiny, dark, irregular line, of $\frac{1}{8}$ or $\frac{1}{4}$ inch, very slightly elevated at the end, where the burrowing mite may be found.

In cases of long standing the lesions may be quite large, pustular, with many large blebs and scabs, and the diagnosis be very difficult to one unskilled in skin manifestations, and the child be in a condition of veritable torment.

Diagnosis.—Most valuable is the history of contagion from other members of the family; nearly always there is more than one case. The areas in which the condition was first noticed, the time of the itching, and the steady progression are all to be inquired into. The lesions are mainly papules,

vesicles and the scratch-marks, as the burrows are frequently disguised and sometimes impossible to find.

Treatment.—This is usually perfectly effective. The child is given a thorough bath with hot water and soap, and carefully dried. After this the following ointment is applied and lightly rubbed in:

Sulphur loti,		
Balsam. Peruv.	āā	℥j
Ichthyolis		℥ss
Adipis benzoinatis,		
Petrolati	āā	℥j

This must be employed, after the bath, for three successive nights and then discontinued. Often this treatment will effect the cure; if not, the same procedure is repeated at intervals until the cure is complete. Weaker or stronger ointment may be employed as seems advisable. Care should be taken not to produce a sulphur dermatitis, and the possibility of this should be borne in mind if the condition at any time becomes worse under treatment.

After the cure all the contaminated clothes and bedding should be boiled.

TINEA TONSURANS. TINEA CIRCINATA.

Ring-worm of the scalp is a common condition in children. The ring-worm of the general surface is not so common nor so important.

Etiology.—The disease is a moderately contagious one, due to the Tinea trichophytina. The common form in children is the Microsporon audouini.

Symptoms.—On the scalp the organism infects the hair, making it brittle and easily broken, and forms a scaly, hyperemic area that soon becomes bald. Often the scaling and the hyperemia are so slight as to be hardly noticeable, the many broken hairs and the bare area only being seen. Often some inflammation develops, most at the periphery of the patch, with vesicles, papules or pustules. This may be very considerable and result in crusting.

On the body surface the ring formation is usually characteristic. Most commonly it is seen on the face, neck, hands and forearms, but may be anywhere on the body. The lesion consists of one or more small, circular, slightly elevated, scaly, pink or reddish spots. They spread at the periphery and tend to clear in the central portion, forming the ring. Irregular figures may be formed by several patches encroaching on one another. After several days the color becomes paler, the spreading stops and leaves a slightly brownish patch that may remain for many days. Usually there are only one or two patches, rarely more than five or six. Eczematous or other inflammation may develop on a ring-worm patch, but this is comparatively rare on the body as compared to the scalp.

Itching is not marked in either form, and usually there is none. Discomfort of any sort is rare unless inflammation follows.

Diagnosis.—In the scalp the points in diagnosis are the baldness and the short hairs, with the absence of active inflammation. The history of contact with other cases, particularly in institutions, is of value. The microsporon can always be found by microscopic examination. Ring-worm of the body is so typical if seen early that the diagnosis usually offers no difficulty.

Prognosis.—Ring-worm of the scalp is sometimes very difficult to cure, but perseverance usually effects it. The hair returns in the bald areas when the disease is eradicated. The other form is much more readily cured. Neither has any bad effects other than the local.

Treatment.—On the skin thorough cleansing with soap and water and the application of tincture of iodine is usually sufficient.

On the scalp the hair around the patch should be clipped close or even shaved. After thoroughly soaping the head the lather is left on for ten or more minutes; it is then washed off and the scalp dried. As good an application as any is salicylic acid, 3 per cent., sulphur, 6 per cent., in vaseline. This must be rubbed in very carefully so as to make it penetrate the skin. This procedure is effective only if the oint-

ment is applied every day, and the washing done three times a week.

Most of the cases of ring-worm of the scalp outside of the Mississippi Valley will yield only to depilation by means of the *x*-rays.

As the disease is contagious, every infected child should be made to wear a muslin cap to prevent the infection of others. In hospitals and institutions every infected child must be isolated, and no such child should attend school.

CHAPTER XVII.

DISEASES OF THE BONES AND JOINTS.

OSTEOMYELITIS.

Definition. This is an acute suppuration of the bone due to the infection of the bone-marrow by some pyogenic bacterium. In infants a very similar process, but sometimes confined to the joint alone, is so common as to be given the distinctive name of acute arthritis of infants, though it usually begins as an osteomyelitis.

Etiology.—Osteomyelitis may be a primary infection, or may be secondary to the acute infections, bruises of considerable severity, compound fractures; not infrequently it develops after exposure to cold, exhaustion, etc., or there may be no suspected cause whatever. It most commonly occurs after six years, but is quite as common from twelve to sixteen years as in younger children. In the great majority of the cases the organism is the staphylococcus, but the streptococcus, pneumococcus, and rarely the typhoid bacillus, or gonococcus, may be the cause. The infection arises from the organism in the circulating blood, except, of course, in the case of fracture. In the acute arthritis of infants the infection practically always takes place through the circulation, the organisms being essentially the same, except that the gonococcus more frequently is the cause. In either form there is sometimes a focus of pus elsewhere in the body.

Pathology. In osteomyelitis the infection begins in the medulla of the diaphysis of the bone, in the great majority of the cases in the femur or tibia. In this way it is often distinguished from tuberculous osteomyelitis, which practically always begins in the epiphysis. Due to the resistance of the wall of bone, the entire medullary portion may be invaded unless an outlet for the pus is provided. The infection slowly

traverses the Haversian canals of the cortex and eventually forms one or more abscesses under the periosteum; the periosteum is often much thickened and infiltrated with pus.

Not rarely the disease extends into the epiphysis and from there to the joint, giving rise to a purulent arthritis. In the variety so common in infants the disease may begin in the medulla, more often in the epiphysis, and sometimes primarily in the joint itself; the latter is the case in gonorrheal arthritis. Wherever it begins, the joint is soon invaded.

Only one bone may be involved, or one joint, as the case may be. Much less often two or more areas are involved. If the disease is allowed to progress untreated, numerous bones or joints are apt to be involved, and the condition becomes one of general pyemia. The joints most frequently invaded are the knee, hip, wrist, and shoulder; the gonococcus infection is very frequent in the small joints of the hand and foot.

Symptoms.—Osteomyelitis usually begins suddenly, with a sharp rise of temperature and pain in the affected area. The affected limb is kept at rest and movement of it is resisted. The temperature soon goes to 103° F., or often higher, and the pulse is rapid. Within a day or two very alarming symptoms may develop, very high fever, delirium, and prostration.

Tenderness over the affected bone is evident and soon becomes exquisite. Some swelling is apparent usually by the second day, and after three or four days there is often some redness. Fluctuation is sometimes obtained within the first three or four days, but it is deep and difficult to interpret; it is generally absent. Rather characteristic is the sudden, sharp pain in the affected bone after prolonged pressure on a part some distance from the infected portion. When the disease is far advanced, because of neglect, the limb may be much enlarged, the infected area red, doughy, perhaps fluctuating, and the entire circumference be infiltrated with serum and pus. At this stage the child is evidently very seriously ill with all the signs of general septicemia.

In the acute arthritis the first symptoms are much more apt to be general, with a high, very irregular temperature, restlessness, and other signs of a severe febrile disease. Within

two or three days pain develops in the affected joint, or very near it, and soon there are swelling, fluctuation, and eventually reddening of the surface. Some cases develop much more gradually and it may be several days before attention is directed to the joint, and suppuration may not occur for ten days or more. And there are cases, unfortunately not rare, in which the onset is sudden and violent, the progress rapid, and septicemia an early development, with a fatal course in a week or so.

In either infection, in severe or neglected cases, secondary infection often occurs elsewhere, in the lungs, heart, meninges, etc. This is much more common in the acute arthritis. Extensive burrowing of the pus may occur if no outlet is provided, as it rarely evacuates spontaneously.

Diagnosis.—The great importance of acute osteomyelitis lies in the fact that it is often mistaken for rheumatic fever, and the results are then disastrous. Many times in a year cases are brought to the children's clinic at Washington University to be treated for what has been pronounced rheumatism, and the child is found to have osteomyelitis with extensive bone destruction. The fact of its being usually confined to one limb, with consistently high fever, progressive advance in one location, and above all the high leukocyte count that accompanied it, in common with all acute pus infections, should serve to place it. And the disease practically always begins at an appreciable distance from the joint.

Acute arthritis is so common in infants, and rheumatic fever so rare, that it should not be confounded. Also it is generally confined to one joint, and there is soon evidence that the joint contains pus, which does not occur in rheumatism. The acute epiphysitis of lues may be similar at the outset, but it nearly always affects more than one epiphysis, is much slower, does not invade the joint, and rarely presents the redness or decided inflammatory signs and constitutional symptoms.

Prognosis.—The condition is a very serious one, even if it is promptly recognized, which it often is not. In osteomyelitis recovery usually takes place with early operation, with

perfect use of the limb. In the arthritis there is frequently permanent stiffness of the joint even with prompt evacuation, and often a fatal outcome from septicemia. In the cases due to the gonococcus the outcome is much more favorable than in the others.

Treatment.—The usual measures of relief in acute febrile conditions are applicable. Cold applications to the affected part should be used. Occasionally infections due to the gonococcus will subside under these measures without the formation of pus. The actual treatment is eminently surgical, and as soon as the focus is definitely established the bone or joint should be opened. The sooner this is done the better.

ARTHRITIS DEFORMANS.

(Still's Disease.)

There is little doubt that the condition described by Still is the arthritis deformans of later years, but with certain features that are much more prominent in children. For a general consideration of arthritis deformans one is referred to works dealing more extensively with the subject; a brief outline of the peculiarities in children will be given here.

Etiology.—It is a rare condition in general, and only about 1 per cent. of cases occur in children up to ten years of age. After this age the frequency slowly increases, but even in older children it is quite rare. So little is known of the causes that a great variety of possible ones has been suggested. The most plausible one is that it is due to some slow-acting toxin, probably of bacterial origin. No specific organism has been identified, and in all probability it is not specific.

Pathology.—The cases are of the periarticular variety. That is, the structures involved are those about the joint, the fascia, tendons, synovial membrane, and to some extent the cartilages. Suppuration does not occur, effusion very rarely. The joints are enlarged, and appear more enlarged because of the wasting and atrophy of the muscles of the limbs. Rather characteristic is the enlargement, through hyperplasia, of the spleen and the lymph glands.

Symptoms.— The onset may be fairly acute, with slight fever and pain and swelling in several joints. The joints are red, swollen, tender, and the larger ones may show some effusion. It may be very much like acute rheumatic fever, but joints are apt to be affected that are not involved in rheumatic fever, as the jaw, clavicle, vertebræ, etc. Also a joint when once affected does not show the subsidence as in rheumatism, and there is some permanent stiffness or enlargement, after the acute symptoms have subsided. And there is constant enlargement of the external lymph glands and nearly always early enlargement of the spleen.

The chronic form has a gradual onset with gradual swelling and tenderness in the joints. There is no redness, no effusion, the pain is usually present for weeks before any enlargement is made out, and it may be a year before there is a general arthritis.

In other cases there is a combination of the two, with several attacks followed by progression as in the chronic form.

The joints most commonly affected early are the knees, feet, hands, shoulders, and elbows. Any joint may be affected, and sooner or later there are always several involved; every large joint of the limbs, and many small ones, may be affected.

Prognosis.— The majority of cases advance until the child is permanently crippled. But several cases of recovery and some of very marked permanent improvement have been reported. There is little danger to life from the disease or complications other than the general weakening effect.

Treatment.— There is no medication that has any appreciable effect. The salicylates are of no apparent benefit. An early diagnosis is important to prevent as much as possible permanent structural changes in the joint. This is done only by attention to the general health of the patient, fresh air, full diet, massage and passive exercise, or active exercise in proper cases. Of course, during acute exacerbations rest and relief of pain are indicated. For details of all these measures the text-books describing arthritis deformans should be consulted.

TUBERCULOSIS OF THE BONES.

The tubercle bacillus is particularly prone to invade the bones of children during the period soon after they have learned to walk.

The great majority of cases of tuberculous disease of the bones and joints occur in children, and particularly in those from two to six years of age; after this age it becomes relatively less frequent. In the majority of cases there is either a family history of tuberculosis, or the history of exposure of the child to the infection through some close association with a person having active tuberculosis of the lungs. A very careful history will elicit the latter circumstances so often that it certainly establishes the danger to a child of such close association with a person who is known to be infected, or who is suspected. As to the bone infection being primary or secondary, there is still a great deal of discussion. In all probability there is an active or latent focus elsewhere in the great majority of cases, and very often the primary focus is palpably in the lymph nodes, and very frequently in the lungs, though there may be no symptoms of either. The role of traumatism is rather uncertain, but there are cases in which an injury has undoubtedly been the determining factor in the location of a tuberculous infection. Parents are quite inclined to ascribe the trouble to a previous fall or bruise, but inasmuch as every child has a number of such accidents there is always one that may be cited as occurring shortly before the bone trouble began. Undoubtedly a severe bruise or hard fall may, and does, cause the advent of a tuberculous bone infection. The factor of the acute infectious diseases is an important one. Although the disease may occur in children previously perfectly healthy, it occurs much more often in those enfeebled by disease, and it is not uncommon for it to develop after one of the infections, particularly measles and whooping-cough. Finally, it is much more likely to occur in children in crowded quarters, with the usual accompaniment of poor food, improper clothing, and lack of fresh air.

Pathology.—The invasion of the bone is the first process, even in the joint infections. This occurs as an osteochon-

dritis of the epiphysis of the long bones; or as a chronic osteomyelitis of the shaft, as seen generally in the short bones of the hands and feet, but rarely also in one of the long bones. The usual appearance of the tubercle, caseation, destruction of tissue, and the formation of the typical tuberculous detritus always occurs, and the joint is invaded by the extension of this process. In the long bones it usually begins at the epiphyseal line, and that portion of the bone, the articular cartilages, and then all the structures of the joint are infected and destroyed to a greater or less extent.

The tuberculous osteomyelitis begins in the shaft of the bone, destroying first the tissue of the medullary portion and then slowly invading the cortex, causing a gradual thinning and final destruction of a very large portion of the bone; the periosteum becomes infected and later there are abscesses of the soft tissues, sinus formation, and often great deformity of the affected part. The joint is rarely invaded.

The formation of abscesses, the so-called cold abscesses, is characteristic of tuberculous bone disease, but occurs more frequently, and in the most typical fashion, in the spine and joints. In caries of the spine the burrowing of this material is sometimes remarkable.

The most frequent location of the disease of the epiphyseal variety is the spine, nearly as frequently the hip, next the knees; the various bones of the ankle, elbow, wrist and shoulder, are affected much less often, in the order named.

The bones most frequently showing the infection of the diaphysis are the fingers and small bones of the hand; the small bones of the feet and toes are much less often affected, and the long bones rarely.

Tuberculous infection elsewhere in the body may be present, or occur at any time, to any extent. But the majority of cases show no other involvement, and the condition is compatible with long life.

POTT'S DISEASE.

Definition. This is an infection of the bodies of the vertebræ. It is properly called *spinal caries*, or *tuberculous*

spondylitis. The inflammation usually begins in the central portion of the body of the vertebra and extends to the disk cartilages, the periosteum and ligaments. If not arrested, the vertebral body is destroyed to such an extent that it is crushed or displaced, the vertebræ above and below being brought in contact and a bend in the spine is produced with the resulting posterior prominence, or kyphosis; this is the common "hunch-back." According to the number of the vertebræ affected, and the amount of destruction, this kyphosis may vary from a scarcely perceptible prominence on the spine to a large, unsightly hump accompanied by extreme deformity of the whole chest wall. Very frequently the sheaths of the spinal nerves are involved, either by inflammation or pressure, and the spinal meninges, and often the cord itself, are affected.

When the destruction is considerable and the process reaches the soft tissues, a frequent development is the *cold abscess*. This consists of a fluid containing the products of the tissue destruction, and the material points forward into the pharynx, thorax, or abdomen (according to the part of the spine affected), and may rupture into any of them. More characteristic is the extensive burrowing down the spine. This occurs most often beside the sheath of the psoas muscle, and may point in the lower abdomen, below Poupart's ligament, or along the thigh. It is often called a *psoas abscess* from its close connection with that muscle.

Symptoms.—The disease begins very gradually and insidiously, and the first symptoms are very obscure. Before anything else the child often complains of pain in the upper abdomen. This is due to the irritation of the spinal nerve roots, and the pain is referred to their endings in the abdominal wall. Cases are very frequently treated for indigestion on account of this pain. In addition the child is apt to be restless, sleep poorly, and is easily tired, and the general health is manifestly not up to par. Careful observation will show that the child spares the back as much as possible, as in helping himself up when rising by pushing with his hands on his knees, or in assuming that posture in

sitting, to relieve weight on the back. Rigidity of the muscles of the back can be made out.

At any time after these symptoms are noted there may be seen a slight prominence of some part of the spine. Later abscesses may form and be discovered in one of their many locations. Occasionally the first intimation of any trouble in the spine is a spastic paralysis of the legs, or the arms and legs, due to pressure on the cord.

The symptoms differ according to the location of the disease, whether cervical, dorsal or lumbar. The dorsal is much the most common site, the lumbar next, and the cervical is least often affected.

The first pains are apt to be in the back of the head and at the side and front of the neck, in the cervical form. The head is held in one position, and movement of it is resisted on account of the pain it causes; sometimes the pains are quite constant, and sometimes caused only by movement of the head. This condition is persistent, does not improve, and should always direct attention to the spine. It is often taken for spasmodic torticollis. At any time the symptoms of paralysis of the legs may develop, even before there is any marked deformity of the spine. This paralysis usually first appears as a weakness of the legs and on examination they are found to be spastic, all the reflexes exaggerated, with ankle-clonus and Babinski reflex. The arms may be affected in a like manner.

The dorsal and lumbar spine involvement causes sharp pains in the lower costal region in front and at the sides, or in the upper abdomen, much less often in the lower abdomen. The child walks with great care, and is careful not to jar the body. The back is held stiff and straight. It is here that the use of the hands on the knees to take weight off the spine is noted. When told to pick up a coin from the floor, the child bends down with one or both hands on the knees, the back held straight, and in rising again aids himself by pushing upward with the hands on the knees. The kyphosis usually develops before the symptoms have become very marked, in distinction from the late deformity of the cervical spine. Rarely there is a slight lordosis preceding the kyphosis.

The lumbar involvement sometimes causes pains in the lower abdomen, or in the groin or thigh, but they are not so frequent nor so severe as in the other forms. It is in this locality, however, that the stiff, exceedingly careful walk, the difficulty in rising from the floor, etc., are most marked. The deformity is apt to occur late, and the characteristic abscess is often observed before the spinal caries is discovered. The paralysis which develops from pressure on the dorsal or lumbar spine is a paraplegia of the same variety as in the cervical disease, but is usually more complete and, of course, does not affect the arms at all.

Diagnosis.—This is only made in the beginning by subjecting a child to a careful physical examination whenever vague but constant pains are complained of in any locality. Spinal caries will be missed in the majority of cases unless this is done. Tests for spinal rigidity, having the child reach to the floor and arise a number of times, and particularly by seeing if the pains subside when the child is put completely at rest, all are necessary often for an early diagnosis. When the suspicion of the disease is once aroused, the *x*-rays will usually show the bone involvement. After the formation of a kyphos, an abscess, or the onset of paralysis, there is usually little virtue in a correct diagnosis. But occasionally a cervical caries will produce a paralysis that is very puzzling, unless one happens to think to carefully examine the spine. And not infrequently the abscess of a lumbar caries has been mistaken for a hernia, and opened under that misapprehension. The spinal deformity of rickets may be suspected sometimes of being tuberculous, but the absence of other symptoms of inflammation, and the ready correction of the deformity, serve to properly place it, as well as the other evidences of rickets.

Prognosis.—The actual outcome of this disease is a matter of difficulty to determine because of the essential chronicity. Most cases take many months or years for their development, have long periods of improvement and recurrence of symptoms, and they rarely die from the actual spinal disease itself. Probably the deaths that can be fairly attributed to the disease through exhaustion. prolonged suppuration,

myelitis and meningitis, etc., approximate 15 per cent. Certainly the great majority grow into adult life. With proper, early treatment the death-rate would be very small indeed.

Treatment.—The general treatment of the patient is of the greatest importance, as in all varieties of tuberculosis. The nutrition should be carefully attended to; plenty of fresh air, often cod-liver oil, and iron, arsenic, or other tonic treatment are of the greatest value.

The keynote of the treatment is complete, permanent rest for the diseased parts for many months. This is accomplished at first only by having the child in bed or on a suitable frame. The details of this must be left to the orthopedist, but it is well to mention here the success attained by means of the Abbott method of operation in the early stage. This consists in bracing the spine by means of a bone splint taken from the tibia and so placed on the vertebral spines as to firmly connect them. By growing in its new place it permanently strengthens the spine and relieves the inflamed parts of the necessary motion attendent on respiration and other involuntary movement. In the proper hands it will undoubtedly prove the best means of treatment.

Abscesses and sinuses are to be treated on general surgical principles, and the abscesses must always be treated with very great caution because of the danger of producing a secondary infection that may prove disastrous. It is of the very greatest importance to make the diagnosis before these conditions have arisen.

HIP DISEASE.

Definition.—In this infection the part first involved is the neighborhood of the epiphysis of the head of the femur, with the subsequent involvement of the hip-joint as described under Pathology. Rarely the original lesion is beneath the cartilage of the acetabulum.

There is a comparatively short period in which the disease is confined to the bone. The joint is soon invaded and the entire joint structure involved, with the formation of the

typical tuberculous fluid. Then there begins the destruction of the joint portion of the femur; the entire head, and even the upper part of the neck may be destroyed, with dislocation and very marked deformity. The abscess often perforates the joint cavity and appears as a large, painless swelling over the hip, or it may point down the thigh.

Symptoms.—As in Pott's disease, the symptoms are gradual and insidious. In the beginning there is first noticed a slight limp, which is often apparent in the morning and wears off during the day. After a while the child complains of pain, which in most cases is referred to the inner or anterior part of the knee. This is a puzzling symptom and is responsible for many mistakes in the early diagnosis of the condition. After a period of perhaps several weeks there often occurs the characteristic, sudden pains during the night. These are ascribed to a sudden spasm of the muscles, after they have become relaxed in sleep, with sudden jarring of the head of the bone against the acetabulum, and the sharp pain which awakens the child with a cry; this may be repeated many times during the night. The limp now becomes much more noticeable, and it is evident that there is something decidedly wrong with the leg. The extremely puzzling thing about these symptoms is that they may decrease and increase in severity for many weeks or many months, without the production of any other symptoms, or perhaps without a hint of very serious trouble, and yet this is the stage during which it is of the greatest importance to make the diagnosis.

In the second stage, that of joint involvement, there is evident deformity of the limb, due to muscular pulling and not as yet to considerable bone destruction. The thigh is slightly flexed, rotated outward, and the foot generally everted. The joint seems quite stiff from the extreme rigidity of the muscles. During this stage there is often pain and tenderness in the hip, disinclination to walk, and irregular attacks of fever. There is usually some infiltration in the neighborhood of the joint, and in this stage the abscess is apt to appear in the thigh, sometimes burrowing long distances down it. Rarely one may present, and even rupture, into the pelvis. This stage lasts from several months to a year.

In the third stage, that of bone destruction, the deformity becomes very marked and the limb quite inefficient. There is considerable shortening, the thigh is strongly flexed and adducted, with marked outward rotation. The muscles are much atrophied. There is practically no motion at the hip, and this is in a measure alleviated by the increased mobility and the lordosis of the lumbar spine, which constantly occurs. The suppuration is a prominent feature of this stage, and may be so considerable as to affect the general health decidedly. This stage lasts for many months or years, and the joint may become ankylosed and remain so for a great number of years, death occurring eventually from some quite different condition.

Diagnosis.—In the early stage this can only be made by careful and repeated examination as to the mobility of the hip when any of the above symptoms are noted. Any degree of apparent rigidity should be interpreted as hip disease, and an *x*-ray taken to confirm or refute it. The case should be watched a long time, even though the decision is against tuberculosis.

Prognosis.—If the diagnosis is made in the first stage, and the proper treatment instituted, recovery will take place in the great majority of cases. In the second stage there is always left some permanent damage to the joint after recovery, and in the third stage the disability is very distressing. There is no actual danger to life, except from involvement elsewhere, or from very long-continued suppuration.

Treatment.—The general treatment, and the indication for complete rest of the affected part, are the same as in spinal caries. Treatment of the limb necessitates careful management, according to the stage of involvement. There is no operative procedure comparable to the Abbott operation for Pott's disease, but complete rest with traction on the affected limb for long periods of time will result in complete or partial recovery, if the process has not extended too far. Definite plans of treatment will be found in works on orthopedic surgery.

KNEE-JOINT DISEASE.

Definition.—This condition, the third in order of frequency, is a tuberculous involvement of an epiphysis in one of the condyles of the femur, more frequently the outer one, or less often the head of the tibia. It is often called "white swelling."

Pathology.—The primary focus and the secondary involvement of the joint occur exactly as in disease of the hip. But sometimes the process extends outward to the periosteum, and an abscess is formed in the soft tissues without much involvement of the joint. In the joint itself any degree of inflammation or destruction may occur, from a simple synovitis to complete uselessness of the joint.

Symptoms.—The earliest symptom of knee disease is slight stiffness of the joint, unaccompanied by pain. Very soon there is a slight limp, and the knee is found to be persistently flexed to a slight degree. These symptoms usually occur at intervals, with periods of freedom, but before long they become constant. And by this time there is intermittent pain in the joint, noticed more after being about. The characteristic night pains are not nearly so frequent nor typical as in hip disease. Swelling is seen much earlier than in hip disease. It is apparent just above the joint, oftenest on the inner side; less often about the head of the tibia. If the joint is invaded, the swelling becomes soon quite typical; the joint itself is much swollen and tapers above and below. There is no evidence of active inflammation, the tumor is smooth, rounded, symmetrical, and there is very little or no tenderness. The knee is now permanently flexed and rotated outward, and there is noticeable atrophy of the thigh and leg muscles. Abscesses form comparatively early, but they usually point at or near the joint, and any considerable burrowing is rare. As the disease progresses the bone destruction becomes considerable and still further deformity results. This is due to backward dislocation of the tibia, which is rotated outward; the knee is now considerably flexed, and the resulting deformity so extreme as to make the limb almost useless.

Diagnosis. This depends on the gradual development of the symptoms, the evident involvement of the bone, and the slight flexion of the knee with slight limp. Rheumatic fever and simple synovitis have much more decided symptoms and can be confounded only if the chronicity has not been noted, or if the case is seen during an acute exacerbation and with an inaccurate preceding history. After the joint invasion there should be no difficulty. It is well to remember the fact that abscess formation may occur above or below the joint without the joint itself being much affected.

Prognosis. The effects are less severe than in the preceding, and a useful joint depends on the same care.

TUBERCULOUS OSTEOMYELITIS. DACTYLITIS.

Definition.—This disease most often affects the fingers and metacarpus, as described under Pathology of Bone Tuberculosis. In the fingers it is often described as tuberculous dactylitis, and is also called spina ventosa; the latter seems hardly a reasonable name.

Symptoms.—In the typical case one or more of the phalanges is affected, most often the proximal phalanx of the index finger. There is an extremely slow, painless swelling of the entire bone, developing into a smooth, firm, shining tumor of a spindle-shape. It may be many weeks before the swelling is noticeable except on close inspection, and several months before the typical swelling is manifest. In the course of months there is a bruise-like discoloration of the skin, at which site an abscess points and is later evacuated. By this time there has been considerable bone destruction, and usually a large sequestrum of dead bone. A shell of new-formed bone usually surrounds the cavity. If left to itself the entire bone is destroyed, more abscesses and sinuses form, and the result is a quite useless finger. The disease is usually of one or two years' duration.

When the disease affects other bones, it appears as a chronic osteomyelitis, with moderate pain, considerable swelling, and the same tendency to destruction of the cortex and the formation of abscesses. It is usually rather strictly localized

in the rare instances in which it affects the long bones, but is not nearly so common in childhood as the disease of the small bones.

Diagnosis.—The greatest difficulty is in differentiating from syphilitic dactylitis. The latter is much more likely to occur in two symmetrical bones, is more often multiple, and nearly always exists with other luetic manifestations. The Wassermann reaction is of great value in deciding, and the tuberculin reaction of considerable value. The tuberculous form is very much more common than the syphilitic.

Treatment.—The same general treatment is indicated as in the other tuberculous lesions, though there is usually not such need of them. The finger should be kept from motion by means of a splint. When abscess formation takes place, the point should be incised freely and all diseased bone removed. This should be done with the strictest aseptic precautions. Usually the indication for opening is not apparent for many months, and it is usually unwise to use surgical measures until the abscess forms.

SYPHILIS OF THE BONES.

There are certain marked peculiarities about the syphilitic affections of the bones in infants and children. The most characteristic are the osteochondritis affecting the epiphyses of the long bones, the syphilitic dactylitis or osteomyelitis, and the chronic osteoperiostitis of the long bones.

Pathology.—The osteochondritis is often called acute epiphysitis, because of its involvement of the epiphyses of the long bones. The cartilage cells are increased, calcification is rapid, and there is considerable serous infiltration of the epiphyseal junction. This results in a decided swelling of the epiphysis, noticeable externally near the end of the bone. If untreated, there may result epiphyseal separation.

As the disease progresses there may be involvement of the periosteum at the end of the bone; secondary pus infection is rare.

The dactylitis is a chronic osteomyelitis strikingly similar to that of tuberculosis, and the same bone destruction,

abscess and sinus formation occur. The periosteum is frequently and early involved, with a great deal of thickening: it may even be the primary lesion. There is a strong tendency to affect more than one phalanx, most often the proximal one, and very often symmetrical fingers. The metacarpal bones are often affected, but to a less extent; the toes and tarsus rarely.

The osteoperiostitis occurs much more often later in childhood, being a manifestation of the so-called late hereditary syphilis; it may rarely occur in infancy. The change is principally in the shaft, which shows a thickening of the periosteum with little initial invasion of the cortex. Sometimes the thickening is irregular with the formation of nodules along the bone. Occasionally there is quite a typical condition in which the thickening produces a forward curve of the border of the tibia, producing the "sabre-blade" tibia. The enlargement may be extreme, and occasionally this occurs near the joint. The bone is always involved to a certain extent, and sometimes there are areas of necrosis, with subsequent abscess and sinus formation. Both tibiæ are usually affected, and the other long bones may be. Essentially the same process occurs in the flat bones of the skull, but this is not so typical of childhood.

Symptoms.—Acute epiphysitis occurs usually in infancy, often being present at birth, nearly always in the first six weeks. The first symptom is pain, which may be so severe as to cause apparent paralysis of the affected limbs. Tenderness is marked, the child crying whenever the limb is moved. There is symmetrical swelling, nearly always both arms, or both legs, or all of them being affected. The swelling is early apparent near the joints, but is not easily seen at the shoulder. Most commonly the elbows, wrists, ankles and knees are affected. If separation of the epiphysis takes place, it is usually shown by crepitation, unusual mobility, and generally by suppuration.

In the mild cases the condition usually subsides spontaneously after a very few weeks. Under treatment it subsides rapidly.

The dactylitis also occurs most often in infants and quite

young children. It is not nearly so common as the preceding nor as common as the tuberculous form. The symptoms are much the same as the tuberculous, but it is generally multiple, is usually accompanied by more tenderness, and has not the extremely slow development and progress.

The osteoperiostitis is most common between the sixth and twelfth years. There is early and marked pain in the limbs, and tenderness over the affected parts. The pain shows the tendency of adult syphilis in that it is apt to be worse at night, and may be so severe as to interfere with sleep. This, with the enlargement of the bone along the shaft, are the only symptoms. The condition is very chronic and after many months may go on to suppuration, abscess formation, and the extensive destruction of bone with the formation of sequestra.

When the flat bones, as of the skull, are affected, there is usually little to attract attention, as the pain and tenderness are not marked. Bone destruction with abscess and sinus production are common.

Diagnosis.—This is much simplified by the use of the Wassermann reaction, which is positive at one time or another in practically every case. The conditions are all fairly characteristic if seen early, especially the epiphysitis. Chronic osteomyelitis of another sort is apt to confuse only if seen late, or in atypical cases. The tuberculous form of dactylitis can be certainly differentiated only by the other signs of lues that are usually present, and by the specific reaction. The two do sometimes occur in the same patient, and this may be very confusing. The history, family history, and a very complete examination are necessary in many cases, and advisable in all.

Prognosis.—This is very good if the diagnosis is made early and the proper treatment instituted, or at least it is as good as in other forms of syphilis. Neglected cases, of course, present great destruction, deformity, and failing general health.

Treatment.—This is the treatment of any other form of lues, and need not be gone into here. With extensive necrosis of the bone surgical measures are needed; otherwise surgery should by no means be resorted to.

CHAPTER XVIII.

THE INFECTIOUS DISEASES.

VACCINATION.

Definition.—Vaccination, or vaccinia, is produced by inoculation of the skin with the exudate from a vesicle of a calf infected with cow-pox. Cow-pox, or vaccinia, is undoubtedly the infection of smallpox, which takes this modified form in the animal. When the human is inoculated as above, he acquires a greatly modified form of smallpox, which nearly completely immunizes him from infection by true variola. When such a person does become infected with variola, he experiences a mild or modified form of the disease which is called varioloid.

Proper Age for Inoculation.—All babies had best be vaccinated before they begin cutting teeth. Early autumn is the preferable time, as the weather condition is usually good, and smallpox usually comes on with the cold weather. Revaccination should be performed at the tenth year, and it is best that it should be done again about the twentieth year. Although it is quite uncertain how long the immunity lasts, and many cases seem to be immune for life, it is pretty certain that the immunity lessens decidedly in from seven to ten years. When smallpox is prevalent, it is wise to revaccinate those persons who have not had a successful vaccination within five years.

Method.—The old plan of vaccinating from a person who has a successful vaccination has given way entirely, in this country, to the use of the bovine lymph. This is mixed with glycerin to make its proper preservation more certain. The material should be kept cold, preferably in an ice-box, if it is kept on hand for any length of time.

Of course, any area of the skin can be inoculated, but the

PLATE I

Vaccine Vesicle on the Sixth Day after Inoculation.
Contents of the Vesicle Serous.

(From Koplik's Diseases of Infancy and Childhood.)

preferable site is the arm at about the insertion of the deltoid muscle. Some parents prefer that girls be vaccinated on the leg, and if this is so, the best point is the upper, outer side of the calf. Everything connected with the operation should be as scrupulously clean as though a laparotomy were in progress. The skin is well cleansed with soap and water and the soap removed with alcohol. Great care must be used to see that the alcohol is completely evaporated, as it may devitalize the lymph. The means of making the abrasion on the skin are various, and none apparently has any advantage over the other. This being the case, it seems advisable to use the simplest, quickest, and least painful; which is the straight, linear scratch with a needle or ivory point. It is not necessary to draw the blood, but the lymph spaces of the cutis must be exposed; drawing blood does not apparently lessen the chance of success. A good plan is to place the virus on the skin and then scratch through it until the skin is sufficiently abraded; then rubbing the vaccine in a minute or so, and allow to dry before dressing. When quite dry, the area is protected by a clean piece of gauze and adhesive plaster, which should remain on for twenty-four hours. When it is evident that the virus is "taking," it is well to again dress the area and keep it protected until a firm scab is formed. This needs no special protection, except against rough usage, until it drops off. The only danger is the secondary infection, either at the time of operation, or after the pustule or scab is formed.

Lately it has been strongly advocated, by Dyer and others, to interrupt the process after the stage of pustulation, remove the pustule, clean the area completely, and dress with some decided antiseptic, as saturated aqueous picric acid. The wound is entirely healed in a few days, there are practically no constitutional symptoms, and the immunity is said to be just as complete.

Lesion and Symptoms.—The lesion produced by a successful vaccination is very constant, differing only in the amount of reaction in the individual case. The original wound heals completely, and after three to five days a small papule appears; after another day or two this becomes a vesicle.

This vesicle enlarges peripherally and about seven days after the operation it develops into a translucent vesicle about the size of the finger-nail (depending, however, on the size of the abrasion) which shows a central depression. By this time there is a decided red areola surrounding it, and the area is firm and infiltrated. It is at this time that the constitutional symptoms are noted. There is slight or rarely high fever, headache, languor and loss of appetite. The neighboring lymphatic glands become enlarged and tender, and the region around the vaccination may be very angry-looking, and, to a novice, alarming. The contents of the lesion become turbid and a pustule is formed, and very soon it begins to dry; by the twelfth to fourteenth day it has become a firm, brown scab. The signs of inflammation have quickly disappeared. At about the twentieth day the scab falls off and leaves a pink scar which soon becomes white, and shows several minute depressions, the sites of the original inoculations.

Abnormalities.— Revaccinations seldom follow this course, the reaction being very much less and the process being complete in less time.

Secondary vesicles may form near the original one, or auto-inoculation take place in several places at a distance. A mild form of vaccinia, usually due to virus of slight activity, is the so-called raspberry excrescence. It is a dark red, granular, insensitive swelling that appears instead of the vesicle, undergoes no change other than slowly subsiding, and leaves no permanent scar. When this occurs, the child should be again vaccinated with other virus.

Complications.— Sometimes the reaction is quite violent and the constitutional symptoms severe, the child being apparently quite ill for four or five days. Not rarely the vaccination is accompanied by a skin eruption, either a generalized erythema, urticaria, or rarely purpura. Other rashes, as erysipelas, impetigo, boils or cellulitis, occur from the accidental inoculation of other organisms. Tetanus occurs occasionally, as it does in any other wound, through neglect of the lesion, breaking of the vesicle, pustule or crust, and admission of the tetanus bacillus.

One extremely curious and much-dreaded complication is the so-called postvaccinal pemphigus. The nature of this is uncertain, but it is certainly a septicemia that shows a predilection for developing after vaccination. For a description one is referred to works on the subject. Inoculation of syphilis and tuberculosis is much dreaded and talked about by the uninformed. It is doubtful if it ever occurs with bovine lymph.

Treatment.—This has been described above. The essential thing is to prevent extraneous infection, and this is entirely possible by the exercise of proper care. Should the lesion be torn off or ruptured, it should be kept dry and scrupulously

FIG. 28.—Postvaccination pemphigus. (Dr. W. H. Mook.)

clean. The shortening procedure above described will doubtless come into general use if it proves to provide the proper immunity.

VARICELLA.

This is commonly known as *chicken-pox*, and is an acute contagious disease with very slight constitutional symptoms.

Etiology.—It is very common in children, and as one attack nearly always confers immunity, it is rarely seen in adults. The virus is contained in the vesicles, and a second person can be inoculated with the disease by using the vesicle contents. It is very highly contagious. The organism which causes the disease has not been determined.

Incubation Period.—This is quite regularly from fourteen to eighteen days, rarely as long as eighteen.

Symptoms.—In the great majority of cases the eruption is the first symptom, although there may be slight fever and general indisposition the preceding day.

The eruption begins as small, widely scattered papules, grouped specially in certain areas, as the face and back, and very often the scalp. Soon after appearing the papule is surrounded by a small, distinct areola, and very soon after this it becomes a small vesicle; sometimes the papule disappears without becoming vesicular. The vesicle dries, often becoming depressed first in the centre, and after two or three days has become a thin scab. This falls off in a few days, leaving a small red or pink scar which slowly disappears; if there has been pustulation, a permanent scar may be left, but never a very noticeable one. New lesions appear from day to day, coming anywhere on the body, or in the mouth and pharynx. The eruption thus lasts for five or six days, and disappears entirely in the course of a couple of weeks. There may be so many vesicles that the skin is nearly covered, though this is rare. The lesions never become confluent.

The temperature usually rises to 101° or 102° F. on the second or third day, there are mild febrile symptoms, and by the time the rash is well out the child usually feels perfectly well.

Complications.—Secondary infection of the vesicles is the only complication of frequent occurrence, and it may cause troublesome ulceration. Erysipelas occasionally develops, and may prove serious or fatal, particularly in infants. Acute adenitis of moderate degree is not uncommon.

Diagnosis.—This is usually very easy, being made at a glance at the skin. The characteristic points are the presence of papules, vesicles and scabs at the same time, in distinction from the similarity of all the lesions in a case of smallpox. The presence of the lesions in the mouth is rather characteristic. And the fact that the child has very slight or no constitutional symptoms usually makes it the probable diagnosis.

Prognosis.—Varicella itself is probably never fatal. It is very rare that the complications are severe enough to cause uneasiness, and very few deaths can be attributed to them.

Treatment.—The child should be isolated from other children. How long the contagion lasts is questionable, but it is well to assume that it lasts as long as the crusts are present.

The constitutional symptoms are usually so slight that they need no attention. It is advisable to see that the child has a free bowel movement, and if there is considerable fever, it may be controlled by the use of antipyrin or phenacetin in small doses. Local treatment consists in keeping the skin clean and free from the probability of infection of other sort. If there is considerable itching, it is usually controlled by the use of carbolized vaseline or a 1 per cent. aqueous solution of carbolic acid.

MEASLES.

(Rubeola.)

Definition.—This is an acute contagious disease characterized by catarrhal inflammation of the respiratory tract and the conjunctiva, and a diffuse, blotchy eruption all over the body.

Etiology.—This is quite the most prevalent of all the eruptive fevers, due to the fact that it is extremely contagious; very few people escape the infection. It generally occurs as an epidemic. It is much more frequent in the winter and spring months, but occurs in isolated cases at any time in the year. Children are extremely susceptible to it, except that there seems to be less tendency to acquire it under the age of six months; cases have been reported in infants a few days old. One attack usually confers lasting immunity. Although it can be hardly doubted that some specific microorganism is the cause of the disease, it has so far failed to be established.

Incubation Period.—This is from ten to fifteen days, with the great majority developing in about fourteen days after exposure.

Just when the disease becomes contagious is unknown, but it is certainly contagious as soon as the catarrhal symptoms appear, and in all probability it is contagious for some time before, so that successful quarantine is a matter of very great difficulty. The contagiousness diminishes rapidly as the symp-

toms subside and the rash fades, and is very slight during the process of desquamation. The time of greatest contagion is probably that of the full eruption, when the other symptoms are also usually at their height.

Symptoms.—The invasion period of measles is about three or four days, during which time the symptoms are those of a marked coryza. Rather characteristic is the redness of the conjunctiva with watery eyes, photophobia, sneezing, thin nasal discharge, and short, dry cough. During this stage the temperature slowly rises, with the accompanying febrile symptoms of malaise, headache, drowsiness, etc., none of which is in any way characteristic. There is usually some redness of the throat, occasionally some soreness, and often there are small red spots on the hard and soft palates, giving it a mottled appearance. It is during this stage, usually two or three days before the cutaneous eruption, that the typical sign of the disease is seen on the mucous membrane of the mouth, the spots described first by Koplik. They are seen in practically every case, perhaps only for one or two days, and are absolutely diagnostic. They are oftenest seen on the buccal membrane opposite the molar teeth, but may be present on any portion of the membrane of the mouth, or in the vagina. They are much better seen by the use of good, natural light, and the membrane must not be allowed to get dry or the spots are likely to be obscured; they are not easily seen in the glare of sunlight. The spot consists of a minute bluish-white point on a bright red surface, which is surrounded by membrane of nearly normal color. Sometimes there are so many of them that the red areola cannot be determined, as they run together, but the tiny spots themselves are always discrete. Every part of the membrane may be thickly sprinkled with them, or they may be very few and hard to find. Usually they disappear completely with the appearance of the cutaneous eruption.

After three or four days, sometimes six or seven, the eruption appears, being first present, as a rule, on the forehead, behind the ears, and about the neck; very soon it appears on the face. The appearance of the child is now such that one familiar with the disease almost makes his diagnosis at a

glance. The name "measly" has come to mean a forlorn, weeping, neglected-looking object, and the appearance of a child in the early stage of the measles eruption is exactly that. The red, watery eyes, held partly shut to diminish the light, the discharging nose, the mottled appearance of the skin, and the dry, often painful cough, form a combination decidedly characteristic of measles. And it is at this time that the constitutional symptoms become considerable. On the second day the rash has extended down to the shoulders and back, and by the third day the trunk is usually covered. On the fourth day it is present on the legs and has begun to fade where it first appeared. By this time, also, the child is usually very much more comfortable or even perfectly at ease. The most severe symptoms are generally present when the rash is fully developed on the face and shoulders, and they usually begin to subside when the rash is well developed on the body; then their subsidence is rapid, the child feeling quite well in a few days.

The skin eruption is first noticed as small, red macules, quite discrete, and not unlike small insect-bites. Soon many of these spots become papules, and then there is a tendency for them to group together and form irregular, often crescentic patches; it is this that gives the peculiar, blotched appearance to the skin. Generally there are areas of normal skin about the patches, but in certain areas, and often all over the body, the patches become confluent, so that nearly the whole skin is covered; never, however, does it appear as a diffuse blush with no unaffected skin discernible. The entire body surface, even the palms and soles, is usually affected by the eruption. The eruption fades first where it first appeared, and leaves a brownish tint to the skin that lasts for several days. With this there is a very fine scaling that lasts from six to ten days after the eruption subsides; it is never the marked desquamation that is so typical of scarlet fever. It is most marked when the eruption has been intense.

Almost any degree of severity may be seen in measles, from the cases in which the child is never ill enough to be kept in bed, to the cases of extreme prostration, high fever, delirium, and all the evidences of serious illness; the latter are fortu-

nately rare. The so-called black measles are cases of great severity in which the child is so ill that the circulation is poor, making the eruption take on a very dark color. Rarely the eruption is actually hemorrhagic, and then there may be considerable hemorrhages from the mucous membranes.

Measles is one of the few febrile diseases which usually does not show a leukocytosis. But it must be remembered in this connection that the leukocytes of young children are more numerous than in adults, and also that a moderate leukocytosis sometimes does occur.

Complications.—These are of very great importance, and are responsible for the mortality and bad after-effects of the disease. Of most importance is bronchopneumonia. Nearly every fatal case shows some degree of pneumonia. It is a much more frequent complication in institutions than in private practice, but it probably develops in 5 per cent. of the latter. The mortality is that of secondary bronchopneumonia in general. Every case presents some laryngitis and bronchitis, and these may become troublesome. Streptococcic or diphtheritic laryngitis is not rare.

Rarely the throat and tonsils are much inflamed, painful, and show patches on the membrane, and in some cases cervical adenitis. In these cases death may occur, as in the so-called streptococcic sore throat, from general sepsis. Otitis is common, generally of the catarrhal variety; but there are many cases of suppurative otitis, usually of both ears. The results are not apt to be as serious as in the otitis of scarlet fever. Conjunctivitis is a regular accompaniment of the disease, and it may become very severe, usually through neglect, and may lead to destruction of the cornea.

Tuberculosis is especially prone to develop during or just after measles. It may appear as a bronchopneumonia, or often as some variety of bone tuberculosis. Diphtheria develops in measles oftener than any other acute infection, with pertussis next in frequency.

Diagnosis.—There is a combination of signs that is always extremely suggestive of measles, *i. e.*, slight indisposition, reddened conjunctivæ, discharging nose, and persistent, dry cough, all occurring with a slight rise in temperature. If these

signs progressively increase, measles should be suspected. The peculiar mottling of the palate is suggestive. Koplik spots are absolutely diagnostic.

Prognosis.—Measles is a very serious disease when it affects infants, particularly in institutions. In St. Louis more children under two years die of measles than of any other of the acute infectious diseases except whooping-cough. In older children it is much less serious, and the danger lessens with age, especially if the child is well cared for in a good home.

The best evidence of the severity of the case, and the outlook, is the temperature. If it is high from the beginning, or it rises again after the eruption begins to fade, the child should be carefully watched for bronchopneumonia. A decided eruption which suddenly subsides is a bad indication, as it means that the circulation is poor; a hemorrhagic eruption often results fatally.

Treatment.—Great care should be taken to prevent infants from developing measles. Isolation of all cases, of course, should be done, as it is certainly well for a child to escape the infection if possible; but the long period of contagion, before diagnosis and isolation are possible, will serve to keep measles forever prevalent, with our present lack of knowledge of its cause.

A child with measles should be kept quiet in bed until the eruption is well developed. The room should be moderately darkened, enough to make the eyes comfortable; but it is a mistake to make it as dark as possible, as the subsequent exposure to the light is apt to find the eyes so susceptible that a severe inflammation may develop. Every measure should be taken to make the child comfortable, and he should never be warmly bundled up in a warm room. If the fever is high and the child restless, in distress from the constant cough, small doses of the coal-tar sedatives may be given. Morphin or heroin may be used continuously for the cough if it is very frequent and distressing. The bowels should be well emptied with calomel or castor oil. A moderate, light diet, with plenty of water, should be given; the child should not be urged to eat if disinclined. In the beginning the eruption may be brought out more satisfactorily, if it is slow in appear-

ing, by means of a warm bath. The eyes should be frequently bathed, preferably with boric acid solution, and if the inflammation is severe, cold cloths kept applied as much of the time as can be managed comfortably. If they become purulent, the edges of the lids should be smeared with vaseline to allow the discharge to escape and to prevent sticking.

When the eruption fades and desquamation begins, it is well to anoint the skin with oil, and then give daily warm baths to hasten the process.

The various complications necessitate the greatest watchfulness, especially bronchopneumonia, laryngitis, and otitis. If the temperature remains high, or suddenly rises again, both ears should be examined with the speculum, the throat carefully inspected, and the lungs very carefully examined. The pneumonia is most likely to occur at the height of the infection, and it should be watched for in every case. These conditions are to be treated as described under their several headings.

If the temperature is very high and the nervous symptoms very marked, the use of cold applications is indicated. This will be viewed askance by the members of the family in most cases, but there is no reason for not doing it, except the circulation be poor, as evidenced by cold hands and feet, cyanosis, etc. If these symptoms are present, the mustard pack should be used, together with the suitable stimulation. In these cases examination will nearly always reveal pneumonia.

If there continues to be some slight fever following the attack, and particularly if the cough persists, the child should be carefully watched for tuberculosis.

It must be remembered that measles is a condition that cannot be shortened or modified by treatment, except as the child can be made reasonably comfortable. And the measles itself rarely needs much treatment.

GERMAN MEASLES.

(Rötheln; Rubella.)

Definition.—This is a contagious disease of mild type, practically always occurring in epidemic form. It is characterized

by extremely slight symptoms, and a rash that is subject to considerable variation.

Etiology.—The disease is undoubtedly contagious, but the organism causing it is unknown. The contagion is not nearly so decided as that of measles, and many people escape it entirely. It is rarely seen under six months, but may be seen at any later age, most often from four to eight years. One attack confers immunity. It is most prevalent in the winter and spring. For a long time it was confounded with both measles and scarlet fever, but it has been shown conclusively to have no connection with either.

Incubation Period.—The usual time is two weeks; it varies from ten to twenty days.

Symptoms.—There usually is nothing that can be called a period of invasion. The eruption is the first thing noticed, and even then the child does not appear to be ill. There may be a slight fever, and some slight general indisposition. The rash usually appears the same day on which the symptoms are noticed. In rare instances there are severe headache, delirium, vomiting, associated with considerable fever. When this occurs, the diagnosis is apt to be very difficult.

Generally the eruption appears first on the face, and the whole body is rapidly affected, so that it may be fully developed on the first day. Occasionally it is observed on the hard palate before it is on the face.

The rash consists of pale red macules or maculopapules about pea size, or smaller, and quite discrete, except that on the face it is apt to occur as large, irregular blotches having a decided resemblance to ordinary measles. The greater part of the body may be affected, but not rarely it is seen on the face and very little anywhere else. In many cases, which are apt to be very puzzling, the eruption assumes the character of a diffuse blush, covering a great part of the body; but nearly always there will be found areas showing the discrete spots that will enable one to make the diagnosis. If none of the spots are found, it will require some courage to insist on the diagnosis of rubella. The eruption may last only for a day, but usually is present for three days. The fever and other symptoms, if there are any, are usually gone in two days, disap-

pearing abruptly with the disappearance of the rash. Rarely there is a noticeable catarrhal inflammation of the respiratory tract, or even a sore throat; if this is the case, the difficulty of differentiating from measles and scarlet fever is increased.

One very helpful and rather constant sign is the swelling of the posterior cervical glands. Itching of the skin may be troublesome. Desquamation is not constant, is readily overlooked, and its absence will usually serve to differentiate from scarlet fever.

Diagnosis.—This is the most important part of the disease, because of the close resemblance to measles or scarlet fever. The most important item is the fact that it rarely occurs except in epidemics, while both of the others occur sporadically. The rapidity of development, practically without symptoms, the anomalous rash, and the enlarged posterior cervical glands, constitute the points of diagnosis. There is no leukocytosis.

Prognosis.—This is uniformly good, and there are no complications to be feared.

Treatment. No active treatment is needed. The principal precaution consists in keeping the child isolated until certain that the condition is neither measles nor scarlet fever.

SCARLET FEVER.

Definition.—Scarlet fever, or scarlatina, is an acute, contagious, febrile disease characterized by sudden onset with high fever, sore throat, headache and vomiting, with very soon a diffuse, erythematous rash.

Etiology.—That the disease is due to some microörganism can hardly be doubted, but as yet there is no certainty what it is. The presence of the streptococcus can be shown as the cause of many of the complications, but it cannot be determined that it is the cause of the disease, and it probably is not. The disease occurs often in epidemics, but sporadic cases are frequent. It is not as contagious as measles, and infants are not nearly so often affected as in measles and pertussis, but children are much more susceptible than adults. In children it is commonest before the sixth year; steadily decreasing

after this. Suckling babies seem to be practically immune. The epidemics occur much more often in the fall and winter.

The disease is nearly always conveyed by contact with the infected person, but it is possible that a third person may carry it, which very rarely if ever happens in measles, even though measles is much more contagious. It may be conveyed by toys, utensils, etc., clothes and food, particularly milk. It seems probable that it may be borne in the air to a certain extent.

The vitality of the organism is very marked, and it may convey the disease through infected clothing, etc., after many months.

The contagion is most active during the first days of the eruption, and is carried by all the secretions. Discharges from the nose, ear, etc., are extremely likely to carry the contagion, even long after the disease has subsided. The scales from the skin have long been considered contagious, but there is no experimental evidence of this; in fact, the experimental evidence inclines the other way. The instances in which the infection has been transferred by a scaling child, who had otherwise perfectly recovered, mean nothing, for the infection may have been conveyed from a focus in the nose, throat, ears, etc. The contagion certainly diminishes rapidly as the scaling progresses. Cases that desquamate for very many weeks are very slightly contagious, and most of these not at all. When infection occurs from such cases, it is quite as likely to be from nasal or other discharge that is so slight as to be unnoticed without a careful examination. But cases of infection do occur after exposure to a child who is absolutely well, apparently, and who has scaled for over six weeks; and perhaps shows at the time so little peeling that it may be easily overlooked, or none at all. But in such cases there may have been some other unsuspected exposure. With our lack of definite knowledge it is best to treat the child as contagious during the entire period of desquamation, no matter how long it lasts.

One attack of scarlet fever confers permanent immunity.

Incubation Period.—This is quite variable, though always comparatively short. The invasion may begin the day after exposure, though this is quite rare. In 50 per cent. of the

cases it begins from the second to the fourth day; most other cases before the tenth day.

Pathology.—This infection shows a remarkable inflammatory condition of the skin, the mucous membrane of the mouth, throat and nose, the ear, and often the esophagus. The corium is infiltrated with serum and leukocytes, often with intense injection; the epidermis is destroyed and cast off, and this is responsible for the desquamation. The inflammation in the throat may be very severe, ulcerative or gangrenous, and may be of the same severity in the ear and in the glands of the neck, with marked suppuration or necrosis. Swelling and infiltration, with acute hyperplasia, is very frequent in the lymphatic tissue throughout the body, and there is often secondary degeneration, or actual inflammation, of the kidneys, liver, etc. Not infrequently there is acute serous or purulent inflammation of the pleura or pericardium, endocarditis, myocarditis, and various lesions in the lungs. Some of these depend on the invasion of the toxic property of the disease itself, and others on the secondary infection due to the streptococcus.

Symptoms.—In the great majority of cases the invasion begins abruptly, the child appearing from the beginning decidedly ill. With remarkable frequency there is the syndrome of headache, vomiting, sore throat, and high fever. The temperature on the first day is usually 102° or 103° F., though in severe cases it is 104° or 105° F. Even in a moderate case the prostration is considerable. And uniformly the pulse is much more rapid than the fever would indicate; this rapid pulse is rather characteristic. At this time examination will reveal a diffuse, bright redness of the tonsils, palate and pharynx. On careful inspection this will be seen to be made up of fine, red points, closely massed together; these may be seen only on the palate. The membranous patches on the tonsils, etc., are rarely seen the first day.

The eruption appears most often the day after the invasion begins; often it is two days, and rarely it appears as late as the fourth or fifth. It begins first nearly always on the neck and upper part of the chest, and usually spreads rapidly over the entire body, often in the course of six hours, rarely longer

than twenty-four. When fully developed, there is an intense red flush to the entire body, and on close inspection it is seen to be made up of tiny points upon a red background, and so close together as to give the whole skin a uniform blush. These points are the sites of the hair follicles and papillæ. The rash does not appear on the face, except in severe cases, though it affects the neck, up to and sometimes including the ears. Rather characteristic is the flushed face (not due to the eruption) with a marked pallor about the mouth and nostrils.

In most cases the rash lasts from three to five days, but often as long as ten; in mild cases it may last only a day, or indeed be difficult to find at all. When very faint, it is best seen in the groin and axilla, about the nates and back of the thigh. Of considerable importance is the frequent presence of fine groups of vesicles in the chest, abdomen, axillæ and groin; this rarely occurs in any other disease that is at all likely to be confounded.

When the eruption reaches its height, all the symptoms have increased in proportion. Headache is apt to be severe, the throat very sore, temperature high and constant, and vomiting forceful. The skin often itches intensely, and there is frequently considerable swelling of the face and hands. All these symptoms rapidly subside with the disappearance of the rash, in the case of moderate severity without complications.

Desquamation is the most typical feature of the disease. It begins after the eruption has subsided, usually by the eighth day, and continues from three to six weeks, rarely considerably longer. The peeling is not in fine scales, as is so often seen in measles, but in large flakes; often considerable strips loosen in one piece. After a very intense eruption the skin of the fingers or hands may come off almost in one piece, as a glove. In areas where the skin is thin the flakes may be small and the process is soon completed: where the skin is thicker, as on the hands and feet, the pieces are larger and the peeling lasts much longer. This is most characteristic. On the hands it is often so typical that the diagnosis of scarlet fever can be made by that alone, after the disease is quite over. The finger-tips peel first, leaving the pink, healthy skin showing, while about them is the dry, dead skin with loosened

edges. Sometimes there is seen what appears to be a second peeling of the palms and soles, due to the tender skin being subjected to too rough treatment in using the hands and feet.

The appearance of the mouth and throat are of great value in the diagnosis of scarlet fever. Even in the moderate cases the tonsils, soft palate and pharynx are red, there is some mucopurulent discharge from the nose, and the tongue often is very red with marked enlargement of the papillæ—the so-called "strawberry tongue." The latter is usually not present before the third or fourth day. The throat may show the most intense injection, with large membranous patches, superficial ulceration, or large areas of necrosis. This may be so extreme as to overshadow everything else, and is then accompanied by great swelling of the cervical glands, and often suppurative otitis media.

The constitutional symptoms vary extremely according to the severity of the infection. In the mild cases they may be so slight that the child is never confined to bed, and the rash may never have been observed, or is disregarded. In the moderate cases the child is evidently decidedly ill, the onset may be with a convulsion, there is great restlessness and often delirium, with the fever constantly high. The eruption is marked, the entire body surface, except the face, being a bright red.

The severe cases are usually so from the beginning, the fever being high, delirium and prostration marked, the pulse very rapid and weak, and death may occur in five or six days, from the profound toxemia. Other cases seem to be of the moderate variety until serious throat involvement occurs. The redness of the membrane is intense, patches appear on the tonsils and pharynx; these coalesce and form large, dirty gray areas which spread until perhaps the entire throat is covered. The cervical glands swell tremendously, often interfering with breathing and the child holds the head back to make breathing easier. The breath is very foul and the discharge from the throat and nostrils profuse. The temperature rises and remains high, the signs of severe toxemia develop, the child is very ill and it seems hardly possible that he could get well; in fact, most of them do not.

This state is much more prolonged than the severe toxic variety, lingering usually for two or three weeks. If they recover, the stage of improvement is very slow, and the danger from the many complications is extreme.

Complications and Sequelæ.—These are of great importance, and add greatly to the seriousness of the disease. The catarrhal inflammation of the pharynx and tonsils is so common as to be considered almost a symptom of the disease; but it paves the way for the much more serious condition which has been described, *i. e.*, the membranous inflammation of the same parts, with the subsequent glandular involvement. These glands may suppurate and require evacuation of the pus, but they sometimes subside without it, even when they have been very much swollen. Occasionally this membranous inflammation may be due to diphtheritic infection, and it is well to take a culture if there is any question about it. Suppurative otitis media frequently follows severe infection of the throat, and is the one most frequent complication of the disease. Both ears are usually affected, and there may be any degree, from mild catarrhal inflammation to suppuration and considerable necrosis. The ears should be closely watched in every case, and if any bulging of the drum is seen, it should be lanced. Cases of permanent, complete deafness are not rare.

Meningitis, peri- and endocarditis, myocarditis, bronchopneumonia, arthritis, and general streptococcus septicemia, are all possibilities, but are comparatively rare.

By far the most important sequel is acute nephritis. Nearly every severe case is accompanied by more or less albuminuria during the height of the symptoms, but this is often a simple albuminuria due to renal degeneration, and it rapidly clears up without causing trouble. In the extremely septic cases there is generally an acute interstitial nephritis with considerable infiltration and the formation of many small abscesses.

But the typical lesion is the diffuse nephritis, the so-called postscarlatinal nephritis. This usually commences after the second week and before the fourth; sometimes it may give no sign until two or three months have passed.

Usually it develops gradually with edema of the face, hands and feet, and slight fever. There may be little or no

discomfort, but there is a noticeable diminution of urine, very highly colored, containing large amounts of albumin, granular casts, and many red and white blood cells and considerable epithelium. More rarely the onset is abrupt, with the alarming signs of uremia. The temperature is high, headache severe, urine nearly suppressed, and convulsions or stupor intervene without any dropsy whatever. The latter is perhaps never recovered from. The first variety often is completely cured, but many cases are discharged as cured, only to die in adult life of a nephritis that probably owed its origin to an early attack of scarlet fever.

The nephritis develops after the mild or the severe cases; in fact, the diagnosis of scarlet fever may be made sometimes on account of a nephritis which develops several weeks after the child had been ill with what seemed a very slight indisposition, and was never suspected of being scarlet fever.

Diagnosis.—The mistake oftenest made in scarlet fever is in relying too much on the rash to make the diagnosis. There are certain erythemas, notably the one which sometimes occurs after the use of antitoxin, which resemble the scarlet fever rash in every particular. Also the rash may be very slight in mild cases; it may appear and suddenly recede in the very severe ones; or it may be an irregular blotchy eruption that is difficult to place. But with the abrupt onset, with headache, vomiting, sore throat and high fever, with the appearance of a rash within a few hours, the diagnosis should generally be correctly made. The tongue often is of assistance, as is the diffuse redness of the throat and palate, and the desquamation usually settles the question, though too late for any value in the acute illness itself. Rarely the diagnosis may be made only by the unfortunate development of a nephritis. The leukocyte count is of some value in doubtful cases, especially if measles or German measles are suspected. There is a moderate leukocytosis of 10,000 to 15,000 in the mild cases, which may be as high as 50,000 in the severe ones, and there is a tremendous preponderance of polymuclears, often as much as 90 per cent. After the first week the eosinophiles increase in number remarkably, and may number 15 to 20 per cent. of the total.

The rash may be simulated by urticaria, drug rashes, influenza, as well as antitoxin rash, rubella and rubeola, or toxic erythema.

Diphtheria may sometimes be suspected from the condition of the throat, but a culture will serve to set one right.

Prognosis.—Scarlet fever is a very serious disease. The general mortality rate is from 12 to 15 per cent., but it varies so much in different epidemics, and is so much higher than this in very young children, that it is difficult to estimate the chance of recovery in any case or in any epidemic. And the apparently mild cases may prove fatal from one of the many complications, especially from postscarlatinal nephritis. Probably half the deaths occur from the intensity of the scarlatinal infection; this is shown by the high fever, which continues to rise for three or four days, marked restlessness and delirium, weak, rapid pulse, and very sore throat. Such cases offer a poor prognosis. The moderate cases which develop the very severe throat symptoms after a few days are also dangerous, and should be given the most careful attention.

Treatment.—The child should be isolated in one room, and attended by a person who does not associate with others. Those going into and out of the room, *i. e.*, physicians and nurses, should use gowns which are kept hanging outside the door. Antiseptic gargles and solutions for rinsing the hands (or washing with soap and water) are sensible precautions. The room should be stripped of all furnishings that are not absolutely necessary. A physician should use exceptional precautions to avoid carrying the disease, but the efficacy of the above, particularly if accompanied by several minutes' exposure in the open air, is manifested by the rarity with which carrying the infection can be attributed to him.

Other children in the house, if they have not been exposed, should be sent away if possible; if they have been, they should be kept from other children for a week, and the temperature taken daily.

The patient should be anointed and bathed daily to remove the scales, after the danger from the disease has passed. When recovery is complete, the child should have a thorough bath, followed by a rinsing with 1 to 5000 bichloride solution,

on two successive days. He may then be considered safe from contagiousness. Every particle of clothing, bedding, etc. must be thoroughly disinfected. Much the same precaution must be taken by the nurse when the case is terminated. Effective fumigation of the room is a matter of considerable doubt, but it should be carried out as far as possible. Formaldehyde, with the aid of moisture, is the most effective. Bedding which cannot be sterilized should be burned.

During the entire course of the fever or other symptoms of illness, the child should be kept in bed, and in moderate or severe cases it is wisest to keep him quiet for a week or more after the symptoms have subsided. The diet should be very restricted, milk, junket, cereals, toast, dry bread, and large amounts of water; in severe cases only milk should be given during the high-fever period. This is the only means we have of preventing nephritis, and even that is not particularly effective; the value of milk over other articles of food containing very little or no albumin is still open to question, but its value in digestibility and nourishing qualities is of prime importance. The continuance of this diet, and the gradual addition of other articles, depends on the progress of the disease and the condition of the urine; this should be examined every day.

The mouth and throat should be kept clean by the use of some efficient antiseptic, such as liquor antisepticus or Dobell's solution. If the throat involvement is severe, with ulceration, profuse discharge and toxic symptoms, the best means of combating it is irrigation with some bland solution, even normal saline. For this a pint, or perhaps a quart, should be used, with a fountain syringe and a small catheter. In small children the catheter may be inserted through the nostril. The best posture is with the child lying across the bed or table with the head hanging slightly over the edge. This may be done every day, twice a day, or even oftener.

Special attention should be given the ears, as their involvement is often unaccompanied by pain, or the pain is quite obscured by other symptoms, delirium, etc. They should be treated as for any middle-ear inflammation.

Swelling of the neck, either due to enlarged glands or cer-

vical cellulitis, needs the constant application of cold; for this purpose an ice-bag, made to fit around the neck, is the best possible means. Cellulitis may require early, free incision, but the glands are best let alone until it is evident that considerable suppuration has occurred.

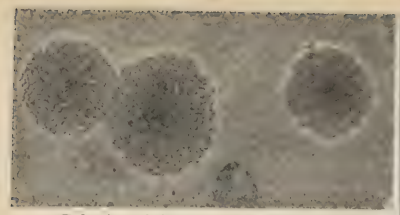
The temperature should not be interfered with unless it is unduly high or long continued. Cool sponging or packs are best used. This is a particularly useful measure when the nervous symptoms are pronounced, and the free sponging may quiet the child more than anything else. Sleep may be induced by means of trional, or similar drug, if indicated, and may be combined with small doses of phenacetin if the fever is high and nervousness marked.

Heart stimulants are indicated if the pulse becomes very rapid and weak. In the cases with severe toxemia, or the bad throat cases, they are nearly always indicated. Digitalis is the one to be most relied upon, and may be given in connection with alcohol. Caffein, strychnin, camphor, etc., must be used if the others seem ineffective.

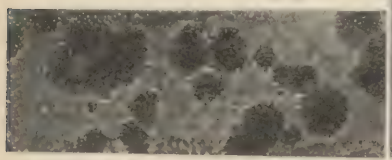
For many years a great deal of work has been done with serum prepared by infecting horses with various strains of streptococci for use in this disease. The reported results have been very conflicting, but some quite favorable. That of Moser, of Vienna, has apparently given the best results, and in the cases of greatest severity. Also there have been many reports of the successful use of immune serum from persons recovering from the disease. Although neither therapy is on the firm basis of general use and thoroughly demonstrated value, they offer something that may prove of great assistance. They should certainly be used to the greatest possible extent, in the hope of successfully combating a disease that now finds us rather helpless.

DIPHTHERIA.

Definition.—This is an acute, contagious disease characterized by the formation of a pseudomembrane on some mucous membrane, usually of the respiratory tract. It is accompanied by constitutional symptoms of varying severity.

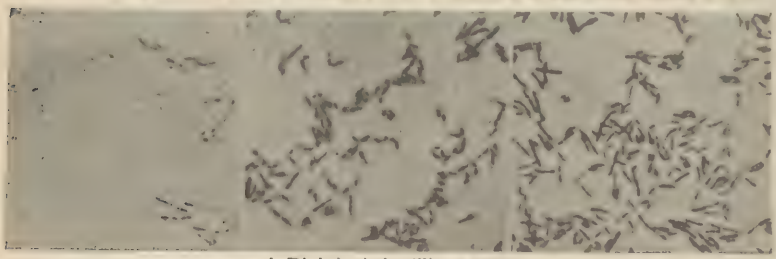


a. Colonies of diphtheria bacilli, × 160.

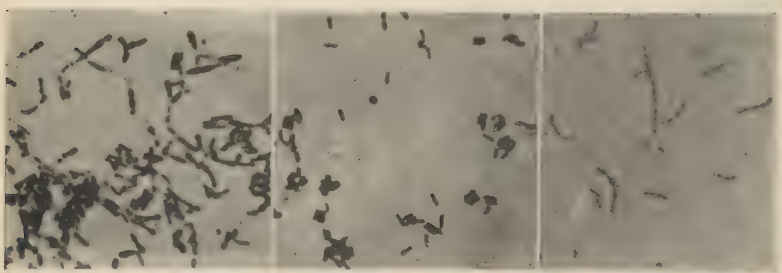


b. Colonies of pseudodiphtheria bacilli, × 160.

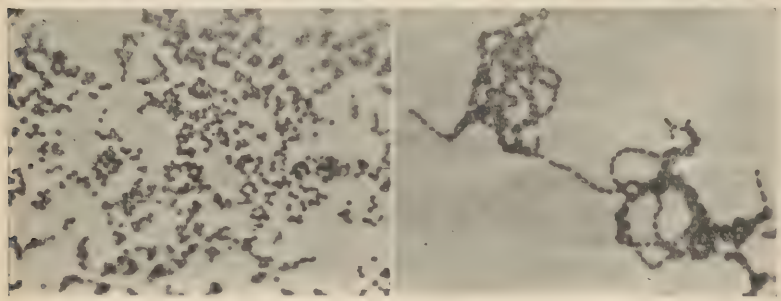
c. Colonies of diphtheria bacilli, × 240



d. Diphtheria bacilli, × 1000.



e. Diphtheria bacilli, × 1000. *f*. Pseudodiphtheria bacilli, × 1000. *g*. Streptococci, × 1000.



h. Streptococci, × 1000. *i*. Streptococci, × 1000.

FIG. 29.—Diphtheria bacilli and streptococci. (Tuttle.)

Etiology.—It is due to infection by a specific bacillus, called the Klebs-Löffler bacillus. The disease occurs largely in the epidemic form, but in all large cities it occurs sporadically throughout the year; it is much more common during the cold weather. It is conveyed almost entirely by direct infection of one person by another having the disease, or who has recovered and still harbors the bacilli. Nurses, companions, doctors, etc., may be carriers of the disease by harboring the bacilli in the throat, but having no evidence whatever of illness. Toys, clothes, utensils, etc., are rare causes of carrying the infection, but well-authenticated instances of this manner of spreading have been reported. The bacilli are contained in large numbers in the discharges from the affected parts, and this is the manner of infection in the great majority of instances. The most contagious cases, therefore, are those in which the discharge is most profuse, *i. e.*, the pharyngeal and nasal cases. The life of the bacillus outside the body is known to be of long duration, and infected material is a source of danger for months.

Children are much more susceptible than adults, and in them the great majority of cases occur. Young infants are not so easily affected as older children and the period of greatest susceptibility is from two to six years. Chronic inflammation of the throat and nose, large tonsils, adenoids, etc., form favorable conditions for its development; and for this reason scarlet fever and measles are not infrequently complicated by a diphtheritic infection.

The Diphtheria Bacillus.—Because of its great importance as the means of making a positive diagnosis in a given case, this is by all means the most important organism with which the practitioner among children has to do. In no way, except by its recognition, can a definite diagnosis be made in a great many cases. And it is such a characteristic bacterium that it can readily be recognized with the microscope.

As it ordinarily exists, in the throat and on a young culture, it is a straight, narrow organism, having a curious tendency to lie in pairs or groups of four or five—the so-called palisade arrangement—or the bacilli lying so as to form various angles. In length they vary considerably. The most characteristic

feature is the appearance of the metachromatic granules in one end, both ends, or three or more, perhaps giving the appearance of a streptococcus. The end dots are situated exactly in the end, a distinguishing point from other granular bacilli. Several differential stains are used for showing the granules, notably the Neisser combination. The best one for accuracy is the Neisser-Gins modification; this will, by careful use, demonstrate the bacilli in a swab from the throat made on a glass slide, without the necessity of waiting for a culture; no other stain will do this often enough to be reliable. The stain is easily made, requires a very few minutes to use, and shows the organism so typically that a glance is usually sufficient to locate them. Every physician who has a microscope, and is apt to encounter diphtheria, will find it possible to use this stain in a very short time. By means of it the body of the bacillus is stained a faint yellow, and the granules appear as very striking black or blue-black dots. The bacillus differs so in size and shape that often the recognition of it depends on definitely demonstrating the granules. The older forms are often much broader than the others, are apt to be curved, club-shaped, appear as diplobacilli, and the typical palisade or angle formation may not be at all apparent; but the dots are always there, if the differential stain is used.

On culture the organism grows to much the best advantage on the medium originally prepared by Löffler, and at a temperature of 34° to 35° C. Often in six hours a growth sufficient for recognition is obtained; and always in eighteen hours.

Incubation Period. — This is from two to six days in the great majority of cases. It may be as late as ten days.

Pathology. This consists in both local and general changes, the former in the area in which the bacilli are growing, and the latter due to the degeneration of certain tissues from the diphtheria toxin which circulates in the blood. The bacilli themselves do not circulate in the blood, except in rare instances, but the toxin is widely diffused.

The parts of invasion are most often the tonsils, uvula and soft palate, pharynx, nose, and larynx; it may extend to any part of the mouth, gullet, trachea and bronchi, internal ear, conjunctiva, or be found in the vagina. The typical lesion is

a pseudomembrane, firmly adherent to the surface, and which causes bleeding if detached. In appearance it is first light gray or white, but often soon becomes dark gray, or yellow; sometimes it is a dark greenish black. It is composed of necrotic tissue, cells, fibrin, and is packed with various bacteria. It tends to spread rapidly to adjacent surfaces, no matter where it starts.

The changes due to the toxins elsewhere in the body consist essentially in degeneration and death of the cells. Most important are the changes in the heart, kidneys, and nerves, all of which are the result of inflammation produced by the toxin, and have no distinctive characteristics. The spleen is congested and swollen, and frequently there are subcapsular hemorrhages. Degeneration of the arterial walls results frequently in hemorrhages, sometimes severe, particularly from the mucous membranes in any part of the body; or from the serous tissues. Wide-spread degeneration of the lymph nodes, especially of the neck, is frequent, and bronchopneumonia, cardiac or cerebral embolism, degeneration of areas in the cord, and areas of necrosis in the liver, are all found with greater or less frequency. The blood shows a moderate anemia and never a marked leukocytosis; in the very severe cases there is frequently a small number of myelocytes, and Engel has stated that their presence is a very bad sign, particularly if they number more than 2 per cent. of the white cells.

Many of the lesions are due to the secondary infection with the streptococcus, pneumococcus and staphylococcus, particularly in the lungs, kidneys, liver and spleen, the ears and lymph glands.

Symptoms.—The local symptoms are the first to appear, and in some cases there may be no other symptoms and the child recover without the disease having been suspected. Most often there is a slight membrane on both tonsils, or perhaps a number of spots. As the disease progresses the membranes spread, or the spots tend to coalesce. During the first day or two the throat is only a little sore, or the child may not complain of it at all; there is little or no discharge, the temperature is 101° or 102° F., the glands at the angle of the jaw

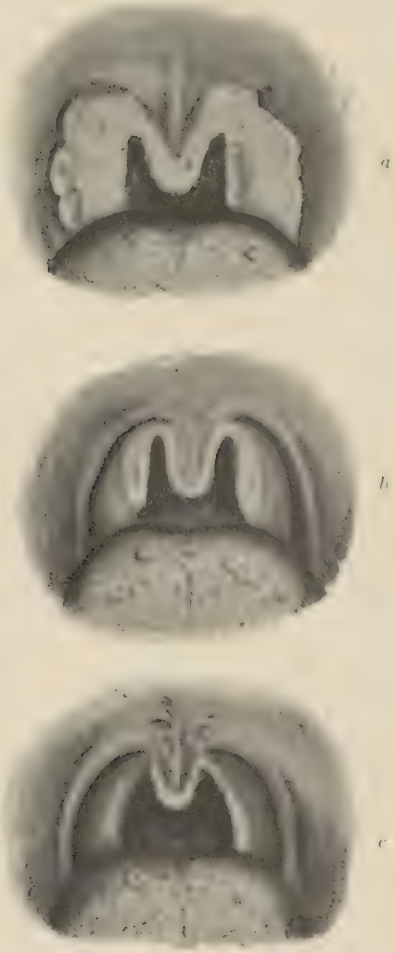


FIG. 30.—Diphtherial infection of uvula and anterior pillars of fauces, showing the disappearance of the membrane after injection of antitoxic serum. *a*, eighteen hours; *b*, twenty-four hours, and *c*, thirty-six hours after injection. (Williams.)

are slightly swollen, and the pharynx is only slightly reddened. In this form of the disease, which is very common, the diagnosis from tonsillitis may be impossible except by culture, but the condition may be inferred from its mildness; tonsillitis is much more likely to present more striking symptoms. If the condition is not recognized, it soon becomes more marked. The membrane spreads up the faucial pillars to the uvula, palate and pharynx, the discharge becomes more profuse, the glands more swollen, the temperature higher, and the child is apt to be drowsy, listless, and appear really ill. On the other hand, the case may clear up gradually and the child be quite well in a few days.

The severe cases often have an onset as described above, though in these days of antitoxin it is not so often that they are allowed to develop. But cases are unfortunately not rare. For two or three days the child is not very ill but becomes progressively worse until in three or four days suddenly he becomes very ill, with high fever, vomiting, sore throat, and noticeable swelling of the cervical glands. The membrane, which has been small in the beginning, rapidly spreads as described. The condition now is quite typical, and one familiar with the disease will strongly suspect it at a glance. There is profuse discharge from the mouth and nose, rather thin, apt to be tinged with blood, and often having an odor that is suggestive of diphtheria. The child is pale, often slightly stuporous, the pulse is very fast and soft, the respiration noisy and labored from the obstruction in the nose and throat, and the cervical glands much swollen. The membrane is spread over the tonsils, palate, pharynx, sometimes on the cheeks and lips, and lining both nostrils; the upper lip is excoriated by the discharge. Sometimes the process begins in the nose, and the condition just described may be several days later in appearing.

The child may remain in much the same condition for several days, and then the symptoms slowly subside, the membrane loosen, leaving a tender, red area where it was attached, and the case go on to a slow recovery, with complete return to normal. Or, much more often, at any time, the symptoms may increase, with prostration and very marked weakness, rapid,

weak pulse, and a state of semiconsciousness and irregular fever, death occurring in a few days.

The great danger, particularly in young children, is in the invasion of the larynx. This usually occurs from two to six days after the onset, and is heralded by hoarseness and a croupy cough. Very soon there is slight difficulty in breathing, which steadily increases until there is stridor, recession of the soft parts of the chest, cyanosis, and the great restlessness that air-hunger produces. If unrelieved, the child becomes unconscious and dies from suffocation.

The catarrhal, nasal, and mild pharyngeal cases are of particular importance in young children because of the likelihood of laryngeal involvement. And the symptoms of this condition are almost entirely local, as absorption of the toxin from the laryngeal membrane is slight. There is little discharge, slight fever, no glandular swelling, and, of course, no discernable membrane. The noticeable symptoms are the obstruction to inspiration, which steadily progresses without remission, with loss of voice, inability to cry, etc., and all the secondary signs of air-hunger. Sometimes the obstruction may be so complete in six to eight hours as to necessitate intubation. The membrane may extend to the trachea and bronchi. Bronchopneumonia is a very frequent development if the child lives long enough.

Not infrequently the mild cases show no membrane at all, and it so often happens that there is merely a gelatinous exudate on the tonsils, or a few spots here and there, that it has become a matter of safety never to attempt to make a diagnosis for or against diphtheria in an atypical case without making a culture. These cases are usually not attended by evidences of serious illness, but experience has taught that they can originate very severe attacks in others.

Nasal diphtheria may exist for a long period of time without causing any symptoms other than the serous, bloody discharge; it is much more frequent in young children, and may at any time extend to other parts.

A very severe type of diphtheria, called malignant, is fortunately rare. It begins more suddenly and is evidently a serious illness at the outset. The membrane spreads rapidly

and deeply invades the tissue. It is usually dark, and often a dirty, greenish black, covers the pharynx and invades the nose, mouth, ears, and perhaps the esophagus. It forms deep ulcers, sloughing of the soft parts, and considerable bleeding. The swelling of the cervical glands is extreme, and there may be marked cellulitis. The fever is high, and all the symptoms in keeping with the very severe infection. The liability to serious damage of the heart, kidneys, lungs, etc., are correspondingly increased, and death usually occurs within a week. The mortality is high, and if recovery takes place, it is prolonged and very apt to be interrupted by one or another sequel of the disease.

In the moderate or severe cases there are certain minor symptoms to be considered. Albuminuria of slight degree occurs with marked constancy, being present by the second or third day and increasing for three or four days more. Often small numbers of casts are found. In all the severe cases there are decided nervous symptoms, restlessness, great excitement, or delirium; but more characteristic, though not so common, is the persistent drowsiness, which is very frequent in the first few days. The anemia is hardly proportionate to the pallor, and this pallor, with the soft pulse, class diphtheria as an asthenic fever as distinguished from the sthenic condition of lobar pneumonia, with the flushed face and full, hard pulse.

Complications and Sequelæ.—Of great importance is the occurrence of myocarditis, due to the toxic action of the disease. It is of frequent occurrence in cases which have gone a number of days without antitoxin, or the very severe toxic cases. The most important sign is the muffling of the heart sounds, with a weak first sound. A very slow pulse is characteristic of the condition, but is not frequent. Quite characteristic also is the so-called gallop rhythm, with three distinct sounds, but this is not common.

Most characteristic are the paralyses of the peripheral nerves affecting the palate and eyes, the limbs, the muscles of the heart and respiration; and some cases that are described as due to paralysis of the pneumogastric. These usually occur two or three weeks after recovery has set in, sometimes

earlier, sometimes as late as five or six weeks. The frequency of occurrence is estimated at about 10 per cent., but it is not so high as this in private practice. The throat muscles are much the most frequently affected, the eyes, legs, arms, heart and respiratory muscles in the order named; sometimes the trunk, or almost the whole musculature. The muscles are powerless and flaccid, and the reflexes lost; there is usually no pain. In palatal palsy the speech is thick and nasal, and food is regurgitated through the nose; if the eye muscles are affected, there is frequently paralysis of accommodation, dilated pupils, or sometimes a squint. Respiratory paralysis usually is preceded by that of other muscles, and is shown by attacks of dyspnea with irregular, unequal breathing; cyanosis is evident at times, and usually several attacks occur, in one of which the child dies of suffocation; but recovery may occur. Impending heart paralysis is shown by irregular, weak pulse, often slow, but becoming very rapid on exertion; if there is marked pallor, air-hunger, and pain over the precordium, the outlook is very bad.

It is often impossible to determine whether the latter condition is a cardiac neuritis or myocarditis, as all the symptoms may be very similar.

The paralysis of the palate, eyes and limbs is usually completely recovered from, though complete restoration may be a matter of many weeks or months. The cardiac and respiratory forms are very often fatal, and treatment is of little avail. All of them are much more likely to follow the severe cases.

Bronchopneumonia, nephritis, otitis, embolism, and severe oral or nasal hemorrhages, are comparatively infrequent complications. Anemia is quite constant, and is marked in the severe cases.

Diagnosis.—By far the most important item in the diagnosis is the recognition of the diphtheria bacillus. If one relies on this in every case of suspicious or doubtful character, he will save himself from being caught; in many such cases there is no other means of diagnosis. This applies particularly to obscure cases of nasal discharge, and to croup. A swab from the membrane or spots in the throat, from the larynx in case of

croup, or both nose and throat, should be made on the proper medium, or examined at once by means of the stain previously described.

The clinical symptoms are often so characteristic that a diagnosis can be made by them, or the condition be very strongly suspected. The membrane itself is often so typical as to be unmistakable. The low fever, drowsiness, lack of complaining, throat not very sore nor very inflamed, the swollen glands in the neck, combined with a gray membrane that is firmly adherent, usually make the diagnosis. This combination of symptoms is not apt to occur in tonsillitis nor in streptococcus sore throat, though the membrane may be strongly suggestive of diphtheria. A sanious discharge from the nose should always be regarded with suspicion, though it may be due to syphilis, or to a foreign body. The presence of considerable albumin in the urine, in all but the mild cases, is of considerable importance. The development of croup, following a membrane or spots in the throat, should be considered at once as evidence of diphtheria without waiting for confirmation. And a membrane that appears on the tonsils and spreads up the faucial pillars should also be considered so. But it is true that the membrane in some severe cases of scarlet fever and membranous tonsillitis cannot be told from diphtheria by any means but the culture.

A late diagnosis may be made from the typical paralysis, or be strongly suspected from the anemia, weakness, evident heart impairment, nasal hemorrhages, etc.

It is the part of wisdom to make a culture in every case, whether the throat is practically certain or quite atypical.

Prognosis.—This has come to depend very largely on the use of the specific antitoxin. In the cases where the serum is used on the first day of the disease practically every case will recover; used on the second day, the mortality slightly increases; and from then on it steadily rises until, after the fifth or sixth day, its value is doubtful and the mortality rises to about 30 per cent. The prognosis depends a great deal on the age of the patient, younger children suffering more severely and being more subject to the laryngeal form, in which the mortality is very high.

An attack of diphtheria does not confer immunity for very long. It is doubtful if immunity lasts more than a few months. And the immunity conferred by antitoxin is probably of about the same duration.

Treatment.– The definite cause and manner of contagion being well known, it is possible, by careful regulation, to do a great deal to prevent the spread of this disease. Children who are ill in almost any way should receive throat inspection, and if there is any suspicious circumstance a culture should be made. In the schools this should be made compulsory, for often a child is in school several days with a very mild diphtheria, or for weeks with the nasal form. Children who are exposed to diphtheria at home should not be allowed to attend school, unless they are found to be free from bacilli, and not subject to further exposure.

Isolation of the infected child should be complete, except for those who are to care for him, and they should not mingle with others without taking the most rigid precautions. Physicians and nurses should wear gowns and caps, cleanse the throat, nose and hands, etc., before coming in contact with others.

In the sick room all unnecessary furnishings should be removed. General measures should be the same as is scarlet fever. And particularly all cloths and vessels containing the oral and nasal discharges should be boiled or burned every day. All utensils, instruments, etc., should be kept in the room, and if possible in a strong carbolic acid solution; such a solution should also be used for the hands. The nurse should take the greatest precautions because of the likelihood of contracting the disease.

When the disease is over, the room should be disinfected, and the walls washed with a strong solution of bichloride of mercury. Every article in the room must be disinfected or burned. The throat and nose of the child and attendant should be proved free from the infection by negative cultures on two successive days. After this a complete bath and change of clothes will render them safe to mingle with others. Public funerals of children dying of diphtheria should be prohibited.

Children who have been exposed to the disease should have

PLATE II

The Schick Test for Immunity in Diphtheria. (Kolmer and Moshage.)

cultures made from the nose and throat; if positive, they should be isolated until free from contagion. The advisability of giving an immunizing dose of antitoxin must be considered in each case; if the child can be closely watched, it is usually as well to wait for the development of a positive culture.

In hospitals and institutions the only safe way is to give antitoxin to every exposed child who responds to the Schick reaction. This consists in the injection into the epidermis of a minute dose of diphtheria toxin. If the skin shows no reaction, the child has enough immune bodies to resist infection to a certain extent; if there appears, within twenty-four hours, an inflammatory papule or areola, the child has not enough immunity to resist the disease, and the antitoxin should be given. It is rather difficult as yet to apply this to cases in general in private practice, but it is of the greatest service in hospitals and institutions.

Quite recently it has been demonstrated that much more prolonged immunity is established by the injection of a certain amount of diphtheria toxin, with enough antitoxin to preclude any toxic effect. It is quite probable that this will prove to have enough practical value to bring it largely into use.

In the actual care of the disease the child should be kept absolutely quiet in bed, on a light, nourishing diet, in which the main reliance should be milk. The severe cases so often refuse to take food that it may be necessary after a few days to feed by gavage; this should not be delayed too long when the child persistently refuses to eat. In doing this it is well to wrap the child tightly in a towel or sheet so that struggling is impossible, and the head should be held so firmly that it cannot be moved; the tube may be passed through the mouth or nose, the latter being often best in older children who struggle wildly and bite the tube. When the throat is very sore, the discharge profuse, and the evidence of intoxication considerable, the irrigation as described in scarlet fever is of very great value, the child being wrapped tightly as in gavage. In less severe cases simple syringing with some bland solution is best, or even gargling, if the child can do it effectively.

All cases which show prostration, whether moderate or

severe, should have stimulation, the best indication for which is the feeble first heart sound. If the heart is considerably affected, none of them seem to have much effect. Alcohol and digitalis form a good combination, given every three hours; caffein is of undoubted value but its effect is transient; camphor in oil is also of value for transient stimulation. Voluntary movement is to be absolutely prevented when the evidence of weak heart exists. Morphin is the one best means of preventing death from heart failure when the signs of irregularity, dyspnea, pain over the heart, etc., exist. Just enough should be used to keep the child quiet. Any other medication at any time is best dispensed with unless some special symptom requires it.

Laryngeal diphtheria requires prompt, energetic action. As soon as croup develops in diphtheria, or when any case of croup is suspected of being diphtheritic, the child should be kept under constant observation. A croup tent is provided as described under Laryngitis, and inhalation of steam begun. Often the fumes from sublimed calomel will relieve the dyspnea to some extent. If the dyspnea increases so that there is evident retraction of the soft parts of the chest, restlessness and anxiety, and no relief from palliative measures, intubation should be performed; it is a great mistake to wait for the deep retraction, cyanosis, and signs of suffocation. Of the two operations, intubation and tracheotomy, the former is now almost exclusively employed. The instrument devised by O'Dwyer is the one that seems to meet the indication better than any other. It consists of a set of tubes graduated for the different ages; a holder for the introduction of the tube into the larynx; another instrument for extubation; and a metal gag for holding the mouth open. A gauge is provided for indicating the size of the tube to be used according to the age; and strong silk or other string for holding the tube so that it can be withdrawn if it is coughed up and swallowed or becomes obstructed and must be removed; for this a tiny hole is provided in the flange of the tube.

To insert the tube the child should be tightly wrapped in a sheet so that struggling is impossible, and held in a sitting posture with the head against the chest of the nurse or attend-

ant, or lying straight on the back. The head should not be held back, but is best in the natural position. The gag is inserted so as not to be in the way of the instrument. A string long enough to reach well outside the mouth is attached to the tube. The epiglottis is found by the tip of the first left finger, and the tube, held by the intubator, is passed straight back, using the inserted left finger as a guide. This finger is held on the arytenoid cartilage of the larynx, and if the tube is passed along this finger, anteriorly, it should enter the opening of the larynx. It must be held perfectly straight, otherwise it is almost sure to enter the lateral ventricle of the larynx. Very little force is necessary, or advisable, as the tube should pass easily into the larynx. If it does not, the inexperienced operator had best do a tracheotomy. The proper insertion of the tube is shown by a whistling inspiration, and a hard, prolonged cough, which may expel the tube. If difficulty is encountered in inserting the tube, the effort should not be prolonged, but the child given a rest and allowed to breathe undisturbed for a while before another attempt. If the tube is coughed up repeatedly, the next larger size should be inserted. The string which holds the tube is fixed to the cheek or around the ear. If it is very annoying and the child makes constant efforts to bite it, it may be removed after the tube has stayed properly in place for some time. The hands should be tied as long as the string is left on the tube. When the tube is properly in place, the relief of the dyspnea is complete, the child becomes quiet and comfortable, and usually falls asleep; but it may be in place and be obstructed by loose or abundant membrane below it. If relief does not occur, it is necessary to perform tracheotomy. Occasionally, after the passage of the tube, the child will cough it up and with it enough of the membrane so that breathing is comparatively easy; if this is the case, the tube may be left out, the child being kept under careful observation.

With the tube in place the child should not lie on the face or be held with the head bent forward, as the tube is likely to be expelled. Feeding with the tube in place is exactly the same as feeding without it, and the danger of having food go down the tube is so slight that it may be disregarded.

In many cases the tube can be dispensed with in three days, or even in two; often it is needed for a week. There is nearly always some irritation, or superficial ulceration at the top and bottom of the tube, but this usually clears up in a few days. Sometimes it may require mild cauterization, and rarely it may cause extensive necrosis in poorly nourished children. Rarely, also, the stenosis may continue after the removal of the tube, even when the disease is entirely cured and the child perfectly well. These cases may be very distracting; a special tube has been prepared for use in such cases. Sometimes the insertion of a tube coated with gelatin containing zinc sulphate, etc., will relieve the condition.

In extracting the tube the instrument itself indicates the manner. The head of the tube is located with the left index finger and the extractor inserted. Often the tube can be expelled by placing the finger externally over the larynx below the cricoid and suddenly bending the head sharply forward, at the same time pushing up on the cricoid.

The *specific* treatment for all forms of diphtheria is the serum prepared by the immunization of horses with diphtheria toxin, producing the diphtheria antitoxin. There is still some prejudice to its use, but only among those who are ignorant of its remarkable effects. It is such a specific that if it is used on the first, or even the second day of the disease, there are practically no deaths. There is a great deal of difference of opinion as to the proper dosage, and this varies according to the age and the seriousness of the case. The initial dose in a moderate case should be 3000 units to a child of one year, 5000 at three years or over. This is to be repeated in eight to twelve hours if the symptoms increase. In more severe cases the dose should be larger, as it should also if the disease is of three or more days' duration.

The value of antitoxin after five or six days of illness is comparatively slight, but one dose of 10,000 to 15,000 units should be given intravenously, to be repeated in six to twelve hours. If no result is apparent, it is doubtful if more will be of any benefit.

Unquestionably the most effective way of giving the serum is in the vein, and the next most effective method is deep in

the muscles. In the mild case, or if given very early, or for immunizing, it may as well be given under the skin, but when quick action is required, one of the other methods is better. In the St. Louis Children's Hospital it has become the rule to give the injection intravenously in every case with laryngeal symptoms, or with large membrane and severe symptoms, the dose never being more than 5000 units. At the St. Louis Infectious Hospital it is being given in the vein in every severe case, care only being exercised that there is no decided myocarditis. The severe serum reaction that sometimes occurs may be decidedly dangerous if the heart is seriously affected. With intravenous administration there is often a chill in from two to six hours, a sharp rise of temperature, and perhaps great restlessness and delirium. One apparent advantage of the intravenous method is the rarity with which the membrane spreads after its use; when used under the skin, the membrane often spreads with great rapidity for eight to twelve hours after the injection.

Certain results of the antitoxins are unpleasant when they occur. There may be urticaria with severe itching, and this sometimes assumes the form called giant urticaria, in which the lips, eyelids, hands and feet may be tremendously swollen, and the general appearance very alarming. Less common there is a diffuse erythema, or pain and swelling about the joints. None of these is of the slightest danger. The general impression of the connection between antitoxin and paralysis is entirely fallacious.

Treatment during convalescence often requires iron for the anemia, or general tonics. The paralysis usually needs no treatment, nor does treatment have much effect. Strychnin, massage and electrical stimulation may aid to a certain extent, if the parts are so situated as to make the manipulation possible.

WHOOPING-COUGH.

Definition. — *Pertussis*, or whooping-cough, is an acute contagious disease characterized by an inflammation of the respiratory tract which causes a peculiar, paroxysmal cough to which the disease owes its name.

Etiology.—It has long been evident that this disease must be due to a specific organism, but it is only within recent years that it has been generally accepted that the bacillus described by Bordet is the cause of the disease. It has not yet been possible to fulfil all the postulates of Koch in regard to a specific infection, but enough has been done to make reasonably sure. The organism is very small and difficult to cultivate, resembling in both features the influenza bacillus. It is found deep in the respiratory tract, and can be grown from the plug of mucus coughed up from the bronchi; it can be demonstrated only in the first few days of the disease. It is manifestly carried some distance in the air, and infection can take place at a distance from the infected person, that is, it is to a certain extent an air-borne disease. Pertussis is markedly contagious, and appears frequently in epidemics; in all large cities it occurs endemically, and is seen throughout the year. It is much more prevalent in the winter and spring than any other time. Children are very susceptible to the infection, and it is more common in young infants than any other contagious disease, and almost one-half the cases occur in infants of two years and under. It shows a remarkable tendency to occur with influenza and measles. Pertussis and measles are the most contagious diseases to which children are subject.

Contagion is carried by the patient, and probably not at all by clothes, toys, etc., nor by a third person. The child is contagious from the time of invasion, and the catarrhal stage in the first ten days is the time of most active contagion. This lessens during the paroxysmal stage, but the child is probably mildly contagious during the entire period of whooping.

Incubation Period.—This is from one to two weeks, and probably nearer two than one in the majority of cases. Inasmuch as the symptoms have been in evidence for a week or more, usually, before it is suspected of being whooping-cough, it is very hard to determine the time of exposure and, therefore, the incubation period.

One attack confers permanent immunity.

Pathology.—The essential lesion of pertussis is a diffuse catarrhal inflammation of the larynx, trachea, and bronchi.

Other lesions are due to the congestion depending on the violent cough, as meningeal hemorrhages, or to secondary infection, as in the very frequent bronchopneumonia.

Symptoms.—The invasion nearly always begins as an attack of moderate bronchitis, and no importance is attached to it. But instead of getting better in a few days it gradually gets worse; and by the end of a week or ten days the cough becomes noticeably paroxysmal, the child gets red in the face, the eyes water, and the cough is noticeably more severe. It is also generally much more noticeable at night. During this time there is no fever nor evidence of illness, nor are there any signs in the chest that account for the cough. Very soon now the child develops the typical whoop, which consists of a long, stridulous, crowing inspiration at the end of the cough, and the paroxysm ends with the loosening and coughing up of a small, firm plug of mucus. When the cough is fully developed, the child, with each spell, gets red and then blue in the face, the eyes water and seem to bulge from the head, the veins stand out, all due to a series of short coughs coming so close together that the child cannot breathe between them; after a succession of them the child takes the long, crowing inspiration and then there are more short coughs, etc., until the plug is loosened, and the paroxysm is over. Although the ordinary, moderate whoop is distressing enough, there are all degrees of severity. The cough produces vomiting so often that this is one of the symptoms of the disease; very few children escape it. There may be complete exhaustion after the paroxysm, and when they are rapidly repeated, the child may be quite worn out. The occurrence of convulsions during the paroxysms is one of the most distressing features and is an indication of their severity. Hemorrhages from the nose, into the conjunctiva, or from the cerebral meninges, are all due to the marked congestion from the severe, prolonged cough.

The child, if old enough to walk, soon grows to know when the attacks are coming, and will stand for support against some stationary object, and usually with his hands braced against his knees. The attacks are brought on by exercise or excitement, shouting, crying, etc., and are easily provoked

after eating, with the result that the meals are often vomited. There may be from ten to a hundred coughing spells in the course of the day and night, but many of them are not severe if they are very numerous. They are apt to be more frequent at night.

The general health of the patient suffers mainly from the interference with sleep, and the inability to obtain sufficient nourishment on account of the frequent vomiting which some cases experience. The child may become very cross, irritable, restless, and lose considerable weight.

The paroxysmal stage lasts from three to six weeks, but often it is continued over a much longer period, when it has perhaps partly developed into a habit. This paroxysmal cough may be very troublesome, and tend to recur with the next cold the child takes, or even a number of times afterward. The disease ordinarily subsides gradually, the coughing spells becoming less severe and fewer in number until they finally stop.

In some cases the whoop may begin almost with the invasion; in some it may be as long as four weeks before the typical whoop is heard. In some cases there may be no whoop at all throughout, and the diagnosis must be made on the nature of the cough, the suffused, bulging eyes, congested face, the vomiting, and the distinctly paroxysmal character of its occurrence. This is particularly apt to be the case in young infants, but the nature of the cough is usually such as to make the diagnosis certain.

A rather important sign in the early stage is the leukocytosis which usually is from 15,000 to 20,000, with a very great preponderance of mononuclear cells, often as high as 70 per cent. in young children. In infants the leukocytes often number 30,000. After the first week of the invasion the number lessens, but the preponderance of lymphocytes is evident to the end of the spasmodic stage, though they become relatively less numerous during this stage.

Throughout the disease there are no physical signs by which it can be recognized, although there is often a moderate degree of bronchitis.

The entire course of the disease is usually six to eight weeks.

Complications.—By far the most important is bronchopneumonia, to which most of the fatalities are due. This is most common toward the end of the spasmodic stage, or at least after it has reached its greatest severity. It is made evident by the rise in temperature, rapid breathing, and the usual signs of pneumonia. Emphysema occurs to a certain extent in every severe case, but is only of importance because of the possibility of making the pneumonia more severe; it subsides after the attack if there is no other complication. The onset of convulsions is a very grave feature, and this occurs more often in pertussis than in any other acute infectious disease. They frequently occur after the development of pneumonia, and such cases rarely recover. Cerebral hemorrhages, usually from the meninges, form another very serious complication, causing death in convulsions, or any extent of paralysis, usually hemiplegia. Tuberculosis of the lungs not infrequently starts during or following pertussis. Hernia and prolapsus ani often occur in infants from the severe cough. In infants with teeth an ulcer of the frenum is often seen. Not the least important complication is the state of debility in which the child is so often left from the exhaustion, loss of sleep, and imperfect nutrition. In summer the diarrheal diseases often make a very serious complication.

Diagnosis.—The typical whoop will usually make the diagnosis. When this is absent, or before it has occurred, the leukocyte count with the differential count is of very great importance in making the diagnosis. The presence of pertussis in the neighborhood, or the history of exposure at the proper interval before, is of value and should be inquired into. The symptoms to be kept in mind are the paroxysmal nature of the cough, usually worse at night, with congested eyes and face, and vomiting, with the lack of anything else to account for it.

Prognosis.—The large proportion of cases occurring in young infants makes pertussis a very serious disease, for it is one of the most fatal of infectious diseases in young infants. This is at variance with the popular notion, as whooping-cough is considered as a good deal of a joke, and it is apt to be carelessly regarded in consequence. The fatal nature of it

lies in the frequent occurrence of pneumonia, and the helplessness of our efforts to prevent this complication. In summer it is apt to be associated with severe diarrhea, but comparatively few cases develop during the summer. And the prognosis must be considered very grave if convulsions occur. In delicate infants, or those with a tendency to tuberculosis, the outlook also is bad. In general the mortality in the first two years may be stated at about 20 per cent., and in the first year it is probably over 25 per cent. The danger from cerebral hemorrhage is rather remote, but it occurs often enough so that it should be borne in mind.

Treatment.— Proper protection of children by isolating cases of whooping-cough seems almost a hopeless task. Children old enough to run about are spreading the contagion many days before they are known to have the disease; and the older ones are usually so little sick that they are allowed to play outside during nearly the whole spasmodic stage. Quarantine regulations are obeyed by the few and disregarded by the many. There can be no doubt about the advisability of isolation, considering the mortality of the disease. Practically no precautions are needed except to keep the child from the possibility of infecting others.

A child with whooping-cough should be kept out of doors as much as possible, where there is no danger of infecting others. If the child is not robust, or for some reason should be kept quiet, the room or rooms in which he stays should be very freely ventilated at all times. The diet should be simple, varied, and nourishing, and the little patient made to sit or lie quietly after eating, so that the likelihood of coughing and vomiting is lessened. If the spasms are frequent and the child vomits often, it is best to give the food in small amounts and frequently. Infants not on the breast should have the milk diluted more than usual. If there is intestinal disturbance, the food must be modified to suit the digestion better.

Medication is of little avail, and the mistake is apt to be made of giving so much medicine that the stomach is upset and the vomiting increased. Inhalations of creosote vapor, or compound tincture of benzoin, as in croup, sometimes are of service. Rubbing the chest with some marked counter-

irritant as turpentine and oil, mustard paste, etc., sometimes helps procure some needed rest. In severe paroxysms when there is danger of asphyxia or convulsions it is quite permissible to use inhalation of chloroform to ward them off. Intubation sometimes is of very striking benefit in the very severe cases not otherwise controlled.

Although many drugs have been used with reports of good results from each of them, the only ones that seem to be of general use are antipyrin and the bromides, and belladonna. The best results are obtained with the mixture of antipyrin and bromide, and still better when they are withheld until the disease has evidently quite reached its climax. A child six months old can take 1 grain of antipyrin and $1\frac{1}{2}$ or 2 grains of sodium bromide every three hours. Often it is best to give it only at night, and in this way the good effect is apt to last longer. Either the bromide or the antipyrin is sometimes effective if used alone, but the dose must be larger, and usually more frequently repeated. If the child is very restless, it can sometimes be given a good night's rest by the use of chloral or trional, but with infants this is hardly advisable. Belladonna is of very great service in some cases, but it must be begun in a small dose and increased up to the physiological limit; atropin may be used, beginning with $\frac{1}{100}$ gr. to an infant one year old. The drugging should depend entirely on the condition of the child and the frequency of the spasms. Very many cases need no medicine whatever and are better off without it. Frequently one is inclined to give the drug more to give the parents a night's sleep than because the condition of the child demands it; this is a doubtful procedure.

With the onset of convulsions the sedatives must be used in the manner described in that section. There are few conditions in which one feels more helpless than in the convulsive seizures of pertussis. Pneumonia must be treated as when it is due to any other cause.

Recently there have been prepared vaccines containing the Bordet bacillus, alone or in combination with others, for the treatment of pertussis. They are also recommended for prophylaxis. This treatment has become known to such an extent that people ask the physician to use it on their chil-

dren. Good reports are so scattering, and adverse reports so frequent that it seems hardly likely that it will prove very effectual.

The method was faithfully tried on some 60 cases at the St. Louis Children's Hospital several years ago and was abandoned because of lack of results. Its prophylactic value seems very doubtful.

MUMPS.

Definition.—Mumps, which is an infectious and contagious parotitis, is characterized chiefly by a decided swelling of one or both parotid or submaxillary glands.

Etiology.—There is no doubt as to the specific nature of the disease, but no very definite work has been done to establish the particular organism. The one reported by Laveran and Catrin is probably the cause of the disease; it is a Gram-negative diplococcus which may be found in the gland, the duct, or in the infected epididymis.

The disease is not very contagious, large epidemics are rare, and many children escape it altogether. It is usually acquired by close contact with an infected person, rarely through materials or a third person. Infants are rarely affected, and it occurs most often from five to twelve years. One attack confers immunity.

The disease is contagious from the time of invasion and continues to be during the time of swelling.

Incubation Period.—This is rather indefinite, but is probably two or three weeks.

Pathology.—Owing to the fact that the disease is not a fatal one there are no postmortem observations, and the condition of the gland is largely surmised. There is an intense hyperemia and edema of the gland, causing not only marked swelling of the gland itself but considerable infiltration around it. Probably the epithelium is affected, causing obstruction of the ducts and diminished secretion. Suppuration is rare, and is always due to secondary infection.

Symptoms.—The moderate and severe cases are about equal in number. In the former it is usually the swelling which first attracts attention, or there may be slight pain at the

angle of the jaw, increased by opening the mouth, or often by taking some acid substance into the mouth. Most often the swelling begins on one side and two or three days later appears on the other. In from two to four days the swelling has reached its height, and the pain may then be quite general; it remains so for a day or two and then slowly subsides. In a typical case the face is tremendously swollen; the face and neck in the neighborhood of the ear may stand out so as to change the entire aspect of the face. Often the other salivary glands are affected later; in fact, they may be affected before the parotids, and rarely be affected alone. The mouth is dry and uncomfortable from the lack of saliva.

In the more severe cases there are one or two days of fever, headache, aching in the back or limbs, loss of appetite, etc. The diagnosis cannot be made until the swelling begins. The fever is usually about 101° F., rarely over 102° F. In older children and adults the disease sometimes takes a very severe form, with great difficulty in swallowing, high fever, great prostration, and sometimes delirium. The constitutional symptoms of mumps usually last four or five days, and the swelling about a week. It may be prolonged another week by the involvement of one parotid several days after the other.

Complications.—These are very rare and unimportant except in children over twelve years; they are not common even then. Orchitis is the most common and may result in atrophy of the testicle; similar inflammation of the ovary in girls may occur, but is usually not so severe. Facial and auditory nerve paralyses are rare sequels, as are also multiple neuritis and nephritis. Suppuration of the gland may occur from secondary pus infection, and by this means other organs may be involved.

Diagnosis.—The diagnosis must usually be made from the nature and location of the swelling. This extends forward to the arch of the zygoma and to the upper part of the sterno-mastoid muscle behind, with the lobe of the ear being at about the centre of the swelling. If such a tumefaction is of sudden occurrence, it is probably mumps. The swelling of cervical adenitis is below the jaw and does not extend to the face; and the swelling takes much longer to develop.

Prognosis.—A fatal outcome is practically unknown except in the rare cases of suppuration with involvement of some vital part.

Treatment.—There is nothing that will have any influence on the course of the disease. The child should be kept in the house and fairly quiet. Unnecessary exposure to others should be avoided. If constitutional symptoms are severe, of course it is best to keep the child in bed and give an effective laxative. If the pain is severe, hot applications are usually comforting. It may even be advisable to give small doses of phenacetin, particularly if there is considerable fever and restlessness. The diet should be light, both on account of the difficulty of chewing, and because the glands should not be excited to secrete any more than is necessary. Possible suppuration should be forestalled by keeping the mouth scrupulously clean.

LA GRIPPE.

Definition.—La grippe, more commonly called influenza, is a contagious disease prevailing in epidemics, characterized chiefly by its invasion of the respiratory tract.

Etiology.—It is due to infection by the bacillus of Pfeiffer, which is found in the bronchial secretions or lungs, but is cultivated with difficulty from the nose and throat. It is highly contagious, is transmitted by contact with a person having the disease, and nearly always occurs in epidemics. When it occurs sporadically, the diagnosis is exceedingly difficult to make without a bacteriological examination. It is very much more common in the winter and early spring. Infants seem especially prone to the disease, but it occurs at all ages. One attack does not confer immunity, some persons having a number of attacks.

The influenza bacillus is a very small, non-motile bacillus which grows only on a medium containing hemoglobin. It is rather difficult to cultivate and demonstrate, and the definite diagnosis of influenza is therefore not an easy matter for the general practitioner.

Incubation Period.—This is short but rather uncertain. It is probably from one day to a week.

The length of the contagion in the ordinary case is probably a matter of only a few days; in the protracted cases a person may be contagious for weeks.

Pathology.—The influenza bacillus produces chiefly a catarrhal inflammation of the respiratory passages, and there is nothing at all distinctive about it. Suppurative otitis media is very common, but there is probably a primary catarrhal inflammation due to the influenza bacillus and the purulent process is due to some other organism. Bronchopneumonia is common, especially in infants, and the influenza bacillus may be recovered from the lungs. The rare cases of meningitis are of the purulent variety, and here also the bacillus may be found alone.

Symptoms.—The disease usually begins rather suddenly with fever, chilly sensation, headache, aching pains in the back and limbs, and prostration which is out of proportion to the evidence of illness. Very soon there is a moderate, persistent cough with moderate coryza. The temperature runs from 101° to 103° or 104° F., and is very irregular, sometimes intermittent. These symptoms continue for three days to a week and rapidly subside. Complete recovery is apt to be a matter of weeks, as the weakness and prostration very often persist in the most unaccountable way.

The severe cases differ in the higher temperature, often as high as 105° or 106° F., and the marked nervous symptoms. The onset may be with convulsions, the headache may be excruciating, or restlessness extreme, and sleep impossible. These marked nervous symptoms are not at all constant; there may be only the high fever, severe aching, and prostration. The temperature is apt to show very extreme variation every day.

In uncomplicated influenza the physical signs are almost wanting. The most frequent, and most characteristic, is the diffuse redness of the pharynx, with perhaps an acute rhinitis. Rather characteristic is a marked erythema of the anterior pillars of the fauces and the posterior part of the soft palate and uvula; this is rather striking and fairly typical of influenza, but is not present in a very large proportion of cases.

Other signs and symptoms are those of the complications.

It is evident that this is a disease with very little on which to base a diagnosis. In infants it is likely to be particularly difficult; and with them it is very apt to cause early vomiting, and not rarely diarrhea. Recurrences after recovery are frequent, and two or more separate attacks are not uncommon.

Complications and Sequelæ.—The most frequent complications are otitis media and pneumonia. In some epidemics the otitis is extremely common, but rarely of as severe a character as that which follows scarlet fever. Pneumonia also is common, but it is apt to be mild and is not viewed with such alarm as the same complication following pertussis. In every epidemic a number of cases of nephritis are seen; they are usually hemorrhagic, and the parents are greatly alarmed by the bloody urine. They usually clear up perfectly. Cervical adenitis is common if there has been much pharyngitis. Sometimes there is a very puzzling rash that resembles scarlet fever of an atypical form; urticaria is not rare and may be distressing. In young children there are often attacks of vomiting and diarrhea that are hard to explain except by the invasion of the intestinal tract by the bacilli. The state of vulnerability of the respiratory tract paves the way for the development of tuberculosis, and this is not an uncommon sequel. Meningitis is fortunately rare, as it is always fatal.

Diagnosis.—This is exceedingly difficult unless there is an epidemic of the disease. In sporadic cases the diagnosis is made probable only by the exclusion of everything else, and by the absence of physical signs. The most valuable point is the weakness and prostration, out of all proportion to the other evidences of illness. The great number of cases of severe head colds that are seen during the winter everywhere are usually called "grippe colds," but they commonly are not. They should not be so called unless the bacillus is cultivated from the discharge. During an epidemic this means of diagnosis is not usually necessary.

Prognosis.—When there are no complications, the cases practically always recover. Infants under six months occasionally die without complicating conditions, except that they are likely to have severe vomiting and diarrhea. Pneumonia, of course, is serious, but not so much so as following

measles or pertussis. The other conditions, meningitis, tuberculosis, etc., have the same significance here as elsewhere.

Treatment.—A great deal can be done toward preventing the spread of influenza by proper isolation. But the period of communicability is so indefinite and often so protracted that it complicates the control of the disease. Children who are known to be susceptible to the disease, or who are vulnerable to any respiratory infection, should be carefully kept from contact with possible la grippe cases.

During the illness the child should be put to bed and kept there as long as the fever and prostration last. It is best to secure prompt evacuation of the bowels. The diet should be light and easily digested, but particular pains should be taken that the child be well nourished. Medication is entirely for the relief of special symptoms, and some of these need attention in nearly every case. Most often it is necessary to give relief from the severe headache and pains in the limbs and back. For this nothing is better than phenacetin, which is combined with bromide if there is much nervousness. Codein, or sodium salicylate may be used with it with good results at times. When the depression is extreme, alcoholic stimulants should be used freely, but this alone is not a sign of special danger. High fever is best combated with cool sponges, etc.

Convalescence should be carefully watched, and the child must not be allowed to return to school and play, etc., as long as any of the weakness or nervousness is evident. This is not nearly so essential as in adults, as the severe nervous sequelæ are comparatively rare. Very often general tonic treatment, with or without iron, is indicated.

TYPHOID FEVER.

Definition.—This is an acute infectious disease, characterized by a rather typical fever and the presence of distinguishing lesions in the intestines.

Etiology.—The specific cause is the infection of the intestine by the bacillus of Eberth. This practically always gains entrance with the food and drink, and in the great majority

of the cases is due to contaminated water or milk. This may be from the use of utensils used by an infected person, from the hands of one who is attending a person ill of the disease, or through wells, cisterns or streams that are contaminated with the discharges. Flies are a very potent cause of spreading the disease by carrying the bacilli on their legs.

In young children the disease is comparatively rare, but it is becoming evident that it is more general than has been supposed. It certainly is not common in babies, due to the fact that the food they take is apt to be heated, and nursing babies naturally are protected by the nature of the food. Due to the great efforts to purify the supplies of water and milk in the cities, the disease is becoming rather a rarity, but in the country districts it is still extremely prevalent.

One attack of typhoid nearly always renders the person immune. There are occasional well-authenticated cases of second attacks.

Pathology.— The lesions are exactly the same as in the same disease in adults, and no detailed description is necessary. The disease usually takes such a mild course in children that the lesions are not in general so severe. There is always some swelling and infiltration of Peyer's patches of the ilium and of the solitary follicles, with the same condition in the mesenteric lymph nodes. There is constant enlargement of the spleen, due to hyperplasia. In the severer cases there is necrosis and ulceration of the patches, but deep ulceration, such as causes considerable bleeding, is rare; perforation of the intestine is quite rare except in children over ten years of age. The parenchymatous degeneration of the liver and spleen is not commonly severe, and degeneration of the heart muscle is rare.

Incubation Period.— The first symptoms of typhoid fever are so indefinite that it is difficult to determine the exact time of onset, and hence to determine the time of probable incubation. According to the severity of the infection, it varies from one to three weeks, and probably oftenest about two weeks.

Symptoms.— In young children the disease differs so greatly from the same disease in adults and children of ten

years or over that one who keeps in mind the adult type will have difficulty in making the diagnosis. The symptoms as they occur in young children will be described here, leaving to works on general medicine the ordinary form of typhoid.

The period of invasion is much more pronounced, the week or more of slight lassitude, headache, loss of appetite, etc., occurring only in the mild cases. Very frequently the onset is abrupt, with fever, vomiting, abdominal distress, and the child stays in bed from the beginning. When the invasion is slower, it is still not so insidious as is common in adults, but the child is quite evidently seriously ill within two or three days. Most often there is a period of slight fever, vomiting, headache, moderate prostration, and some abdominal distress, which in three or four days has become so pronounced that the child stays constantly in bed. Diarrhea usually occurs early, but it is not such as to excite remark, and the typical typhoid stools are infrequently seen. Often there is only a moderate looseness of the bowels, and in many cases there is moderate constipation; this is a point that should be remembered. The tympanites, which is so characteristic, is of moderate degree and rarely troublesome, but it is usually present, and may be considerable if the child is constipated. The spleen is regularly enlarged, soft, and is palpable by the end of the first week.

The temperature shows the tendency to gradual ascent, remaining high for a week or more, and then gradually descending. But this is rarely so typical as in the adult form, and the daily remissions are nearly always considerable. In the early stages it usually rises much more rapidly, and is often very irregular. It is high, 103° to 105° F., the greater part of the day during the severe stage of the illness. Very often the fever rises abruptly to 102° or 103° F. in the first day or two. The pulse shows the characteristic tendency to slowness compared with the height of the fever, and is often dicrotic.

Prostration and weakness are marked, varying according to the severity of the disease, and the loss of weight is quite as rapid and extreme as in adults. With the prostration, and usually in proportion to the degree of prostration and fever, there are apathy and moderate stupor; and very

frequently there is great restlessness and inability to sleep at night, and the child is conscious enough to complain of severe headache.

The tongue is often of great significance, being first quite red and clean, but soon becoming coated brown in the centre, with the tip and edges a bright red. The mouth becomes dry and glazed and the lips covered with dry scales and the teeth with sordes.

The eruption is disappointing as a diagnostic point, as it is often absent, or so scant as to be unnoticed. When it is present, it consists of the small rose spots appearing early in the second week, on the abdomen most often, and in successive crops. They are usually present for eight or ten days, each spot lasting for two or three days.

The urine shows the same characteristics as in adults. In the severe cases there is nearly always some albumin, the Diazo reaction is positive, and there are often large numbers of typhoid bacilli present. Examination of the blood shows no leukocytosis, and very often a lessening of the eosinophile cells. Most important is the presence of bacilli in the blood, and in the first week they can nearly always be demonstrated by blood cultures; the Widal reaction is of less value, but furnishes a greater aid in the second week and later; it is not often present until the beginning of the second week.

Intestinal hemorrhages are not nearly so common as in adults. They are most apt to occur at the end of the second week or the beginning of the third, are seen only in the severe cases, and are apt to be very dangerous. A serious feature is the danger of a concealed hemorrhage, in which the black, large stool is not passed for many hours after the bleeding has taken place. Perforation of the intestine is quite rare. Hemorrhage is indicated by sudden collapse, pallor, drop in temperature, and rapid pulse, without abdominal pain: perforation is attended with the same evidence of collapse, but with sharp abdominal pain, distention, and later a leukocytosis.

Complications and Sequelæ.—The most common complication is bronchitis. In many moderate, and most severe cases, there is considerable cough because of this. Pneumonia and

pleurisy, with or without effusion, are infrequent complications. Complications eleswhere are rare, but otitis, venous thrombosis, arthritis, and many nervous conditions, especially chorea, occasionally occur. Although the urine often shows some albumin, nephritis and cystitis occur only rarely.

Diagnosis.—The most important clinical points are the fever, the enlarged spleen, the abdominal distention, and the eruption. When the fever has continued for several days, and there are no other signs suggestive of typhoid, it is best to employ the earliest and most positive means of diagnosis, the blood culture; this is not likely to be positive after the first week. During the second week the Widal reaction of typhoid bacillus agglutination with the patient's serum is of very great importance, and if definitely positive, is nearly conclusive. The bacilli may very often be demonstrated in the stools and urine by special cultural methods. The Diazo reaction in the urine is of some value, but has fallen into disrepute because it is present in so many other conditions.

Malaria and general miliary tuberculosis are the two diseases that may most closely resemble typhoid. The former nearly always has an intermittent fever, and the fever can always be made to subside with quinine, which it will not do in typhoid. It may not be possible to differentiate tuberculosis until signs of local involvement appear. The different forms of intestinal inflammation have much more decided intestinal symptoms, and the fever is not so high nor so constant.

Relapses occur in less than 10 per cent. of the cases, usually from ten days to two weeks after the fever has returned to normal. They resemble the original attack, but are shorter and milder. If the original attack was a severe one, the relapse may be very serious.

Prognosis.—As the disease is generally milder than in adults, so the prognosis is generally good. The mortality is less than 5 per cent., and the complications few and rarely serious.

Treatment.—The child should be put to bed and kept there for at least a week after the fever has subsided; getting

about earlier is inviting a relapse. The diet should be such as is very easily digested and very nourishing; milk and eggs should furnish most of it, water being given very freely. Broth, egg albumen, junket and well-cooked cereal gruels may be used for variety. It is best to give both food and water at frequent, regular intervals, food every three hours, and water every hour or two. If the child takes a good quantity in the day, it is best not to disturb it at night except to give water. In the first few days it should be seen to that the bowels move well, giving castor oil or calomel; later in the disease the movements are best secured by means of enemata. Diarrhea is not often severe enough to require attention; if it becomes excessive, it may be controlled by small doses of paregoric, with or without bismuth.

The best and most effective method of reducing the fever is the cool sponge, pack or bath; in fact no other means should be tried. With little children, sponging with quantities of cool water, while lying on a rubber sheet, is very effective; it may be done so carefully as not to be startling, and is not apt to cause chilling or delayed reaction, fright, struggling, etc.

The baths are best employed only if the fever is above 102° F. for some time. They may be repeated as often as every four to six hours. They have decided effect in quieting the child and inducing sleep if there is much restlessness and insomnia.

Particular attention must be given the mouth and tongue, using some mild antiseptic for rinsing, and cleaning the tongue, teeth and lips as much as possible.

If the temperature is not high and the nervous symptoms are marked, they may be relieved by phenacetin, trional, etc., alone or in combination with the bromides. Sponging may be of some effect.

In the more severe cases care must be taken to prevent the formation of bed-sores by frequently changing the position, keeping the skin clean, and frequently rubbing with alcohol.

If intestinal hemorrhage is noticed, or strongly suspected, a quieting dose of morphin should at once be given and cold applied to the abdomen; no food should be given; if stimulation is needed, alcohol is the best, the child being kept under

the influence of morphin for as long as twenty-four hours, and the alcohol continued for that length of time. Afterward feeding must be cautiously undertaken.

Perforation of the intestine calls also for the use of morphin until laparotomy can be performed.

In the severe cases some stimulation is usually necessary at the end of the third week. If it is, the best combination is whisky and digitalis.

The urine and stools should be disinfected at once after passage. This may be accomplished by the use of cresol, phenol, or chlorinated lime. All soiled clothing, bedding, etc., should be placed for soaking in the same sort of solution or should at once be boiled. The utensils should be sterilized, and none should be used elsewhere without being sure of their cleanliness. Flies should be watched for and killed if they enter the room; nothing that is contaminated should be put where flies can have access to it. If the urine is seen to contain quantities of bacilli, it can be freed from them by the use of hexamethylenamin, 2 to 5 grains four times a day, until the urine is clear.

Typhoid fever is undoubtedly carried at times by patients who have such a mild form of the disease that they are not confined to bed, or by those who have recovered perfectly but still harbor the bacilli in the urine or stools. These cases are very hard to get hold of, and very hard to control, but much can be done by being assured that no child who recovers is a carrier of the disease.

The immunization to typhoid fever has gone past the experimental stage, and it is now certain that immunity lasting for several years is possible by injecting killed bacteria into the tissues. This is now done in three injections about a week apart, the first being a dose of 500,000,000; the second two of 1,000,000,000 each. With young children it is best to use smaller doses. The injection may cause a decided local reaction, with slight constitutional symptoms for a day or two, but never has any serious result. Treatment of the disease itself by means of vaccines has been tried, but as yet there have been no results that would justify a belief that it is of decided benefit.

MALARIA.

Definition.—This is an infectious disease due to the presence in the blood of a specific organism belonging to the protozoa; it is characterized by intermittent fever, enlarged spleen, and moderate or severe anemia.

Etiology. The organism was first described by Laveran in 1880 and is called the plasmodium, or better, the Hematocytozoön malariæ. There is only one method of infection, and that is by the bite of a mosquito of the family anopheles, which has previously sucked blood from a person infected with malaria.

The plasmodium lives in the bodies of the red cells, which it gradually destroys, and the liberation of the young organisms, formed by the complete maturity of the plasmodia, produce the phenomenon of the chill with subsequent rapid rise of temperature. The young forms enter other cells, and the progress of the disease goes on in this way. There are three different forms, all of which are seen in this country; of these the tertian, with a growth cycle of forty-eight hours, is very much the most common, the estivo-autumnal, with a cycle of twenty-four or forty-eight hours is less common, and the quartan, in which the cycle is seventy-two hours, is very much rarer. For detailed description of the parasites one is referred to works of general medicine.

Malaria exists chiefly in the warm climates where there is a considerable rainfall, or favorable breeding places for the mosquito. The low lands in the southeastern part of this country are the principal locality. In the Rocky Mountain country it is almost unheard of. It occurs much more commonly in the spring and fall, but not rarely it may be latent in the body and develops the typical symptoms in the winter. All ages are subject to it, and children are rather more susceptible than adults.

Pathology.—The chief effect of the organism is the destruction of the red blood cells, which are markedly diminished in number; there is a corresponding decrease in the white cells, with a relative increase in mononuclears. The hemoglobin is reduced. Quite typical is the production of pigment from

the destroyed hemoglobin, and this is found in the liver, spleen, and other organs. In severe cases this may be visible, after death, in the cut organs as a greenish-black deposit. The spleen is invariably enlarged, congested and pigmented; in acute cases it is soft, but in chronic malaria it may be very large and exceedingly firm. Other changes in the organs are rare in children, in this country at least.

Incubation Period.—This is naturally very difficult to determine, because it usually is not known when the person was bitten by the infected mosquito. In general it is about ten days, but undoubted cases are on record in which the disease remained latent for months after the time of infection. It is not rare for it to occur several weeks after.

Symptoms.—In the tertian form, which is much the most common in this country, the disease begins suddenly with a severe chill lasting from ten minutes to an hour. This may be preceded by a feeling of languor, headache, and aching in the limbs. The fever rises sharply and may be 103° or 104° F. by the time the chill is over. This is immediately succeeded by the hot stage; the child now complains of being too hot, the face is flushed, whereas before it was pinched and blue; the headache is often intense, the breathing rapid, the pulse full and hard, and the child complains of the excessive heat.

The temperature continues to rise, and often goes to 105° or 106° F. Profuse herpes may appear on the lips and face, or there may be urticaria or erythema. This stage lasts from two to four hours, and there follows the stage of sweating. The fever now sharply declines, a profuse perspiration breaks out, the child at once feels much better, and in from one to three hours feels quite well except for the weakness that remains. The sweating is often so profuse as to saturate the clothes. Before the sweating has ceased the temperature is down to normal, and by the time it is over is below normal.

The only signs of the disease are those of inspection during the paroxysm, and the palpable enlargement of the spleen. The blood usually shows no leukocytosis and often a leukopenia.

In the tertian form this is repeated every other day. If there are enough organisms segmenting at different times, the paroxysm may occur every day. The above is the form of malaria called the intermittent fever.

The estivo-autumnal form is often called remittent fever, because of the fact that the temperature may remain high for considerable periods of time. But in uncomplicated cases the intermissions are marked, though the temperature stays high for a number of hours, perhaps sixteen to twenty. There is rarely a distinct chill, its place being taken by headache, nausea, restlessness, depression, and severe pains in the back and legs. The temperature rises to 102° or 103° F. and soon the hot stage begins, much as in the former variety. The temperature now falls slightly, rises still higher, falls again and rises until it goes to 104° F., rarely higher. There is a sharp fall to normal with very little sweating. After an intermission of four to eight hours the next paroxysm begins. The whole attack may be of twenty-four hours' duration compared to eight to ten hours in the tertian.

The enlargement of the spleen is quite as constant as in the tertian.

The quartan is not distinguished from the tertian except that the fever recurs every third day.

Any of them may develop into the pernicious form, which is characterized by the extreme severity of the symptoms, the continuous fever, the vast number of organisms in the blood, and the often fatal outcome. It is very rare in this country.

In very young children the typical chill is uncommon, it taking the form of gradual prostration, with cold hands and feet, blue, pinched face with pallid cheeks; vomiting is very common. In infants there may be an initial convulsion as the temperature rises. The fever is often very high; one child under close observation had a rectal temperature of 107° F. in three successive paroxysms. The sweating stage is slight in young children and may be absent in infants.

Cases are not rare in which the attacks may occur at intervals of two or three weeks, the child having only one paroxysm each time.

Irregular forms are so common in children, and take such a variety of disguises, that it is a good plan to examine the blood for malaria in every case of obscure ache, pain or fever. The malarial cachexia, in which the child is anemic, emaciated, sallow, weak and languid, with a very large spleen, etc., is fortunately rare.

Diagnosis.—In the typical case the diagnosis is easy. In the case which is not typical the diagnosis rests entirely on the examination of the blood. The presence of the organisms is easily demonstrated in the majority of acute cases with the typical paroxysm, if the blood is taken a few hours before the time for the chill to appear. But it is often a very difficult matter in the atypical case, or the one in which the symptoms are vague and indefinite. And it is in just these latter cases that their discovery is most important. Several schemes for examining the centrifuged plasmodia, using a larger amount of blood than is obtained by the simple smear, have been devised, and they should be used in doubtful cases. The therapeutic diagnosis by means of administering quinine may be valuable but it is not scientific, and always leaves one in doubt if the fever subsides. The diagnosis of malaria without a palpable spleen is always a doubtful one.

Pyelitis, empyema, or a suppurating process anywhere, may resemble malaria, but the fact that there is not a leukocytosis in malaria serves to differentiate. Conditions in which the spleen is enlarged, particularly if accompanied by fever, may be puzzling, as typhoid, septicemia, general tuberculosis, etc. These are the ones in which quinine is helpful, if the doubt cannot be otherwise dispelled.

Prognosis.—This depends on the diagnosis. With prompt treatment with quinine recovery should take place in every case. The danger lies in allowing the disease to go on to the pernicious form, or to weaken the child so that permanent recovery is impossible; or some other disease may attack the debilitated child.

Treatment.—Keeping the child from the bites of mosquitoes will prevent infection. These mosquitoes bite only in the early evening, and never fly very high, so the proper precaution is easy.

During the attack practically nothing can be done to relieve the discomfort. Artificial warmth, or a warm bath may help in the cold stage, and ice-cap and cool sponging in the hot stage.

The important thing is to prevent the occurrence of the next chill. This is done by the administration of quinine, or more recently by salvarsan. Before the quinine is given the bowels should be emptied with some saline laxative. Then the drug is given in solution. Older children and babies can take the simple solution without the taste being disguised. Those from two to four or five are best given it in syrup of chocolate or some other liquid with a very positive taste. An infant one year old should be given 12 to 16 grains a day until the fever remains normal. A child of five should have 20 grains, or more if necessary. When the fever has permanently subsided, it is best to give small doses daily for a week or ten days. If there is evident anemia, iron or iron and arsenic should be employed.

Recently a number of cases have been treated at the St. Louis Children's Hospital and the St. Louis Infectious Hospital with a single dose of salvarsan. The fever did not recur nor could the organisms be found in the blood afterward. These were undoubted symptomatic cures; what the ultimate result will be cannot yet be said.

RHEUMATIC FEVER.

Definition.—The status of rheumatic fever, or acute rheumatism, as an infectious disease is hardly doubted now. It is characterized by painful swelling of various joints and is of great importance because of the frequent involvement of the heart.

Etiology.—Although the specific cause is still a matter of controversy, the evidence is largely in favor of the organism described by Poynton and Paine and called by them the Diplococcus rheumaticus. It is apparently closely related to both the Streptococcus pyogenes and the pneumococcus, being perhaps an intermediate form, and in the same way is related to the Streptococcus hemolyticus and Streptococcus

viridans, both of which are also pathogenic. It has been cultivated from various lesions occurring in acute rheumatic fever, and has been grown from the blood.

The disease occurs very rarely as early as three years, and is not at all frequent up to five years. After this age it is very common in children up to the age of puberty. Heredity is an important factor, as shown by the number of parents and the children in the same family who are affected. Dampness, cold and exposure predispose to attacks. Recurrences after the first attack are very common. It is very doubtful that the disease is in the least contagious. And the manner of infection is unknown.

There exists a remarkable but conclusive relationship between acute rheumatism, chorea, and acute tonsillitis. It is quite possible that the tonsils may offer one means of entrance for the organism. Certainly children are so frequently affected by two of these conditions at the same time, or subject to two at different times, and repeatedly—and subject so often to the same complications—that it can hardly be regarded as a coincidence.

Pathology.—In the joints there is dilatation of the vessels, marked serous exudation into the tissues, and the entire joint is much distended. This usually subsides without joint impairment. In severe cases the joint may be permanently crippled from the formation of scar tissue, but this is very rare in children. The cardiac lesions have been elsewhere described. A very typical pathological formation is the rheumatic nodule. These are small, oval, fibrous formations just under the skin, usually along the tendons and the bony prominences of the joints, along the spine, about the scapula, ilium, and the extensor tendons of the fingers and toes. They are especially common in children, and particularly when the heart is seriously affected.

Symptoms.—Rheumatic fever in children is seldom of the acute type that is seen so often in adults. Generally the onset is not acute, there is slight swelling and pain in the joints, the fever is not often over 101° F., and the child is often up and about most of the time. Rarely is he sick enough to remain quiet in bed. There are usually several

joints involved, most often the ankle, knee, elbow, wrist, and the small joints of the foot, less often the hand. When one joint alone is affected, it is usually of the lower limb. The lack of swelling, redness, and tenderness is generally very misleading, and many of the attacks go along in this way for two to four weeks and get well without treatment, without one having known that it was rheumatic fever. The joint is always somewhat stiff, the child limps, or uses the arm poorly, and there is a good deal of muscular spasm about it.

Of vastly greater importance is the strong tendency to invade the endocardium, paricardium, pleura, etc. Even from the stand-point of diagnosis the joint symptoms are often of secondary importance. It not infrequently happens that a child complains only of vague pains in the limbs, is never ill in bed, has no apparent fever, and yet after two or three weeks will develop acute endocarditis, and have the typical rheumatic nodules about the joints. These pains are often dismissed with the belief that they are "growing pains," and their nature never suspected; but later a severe attack of rheumatism, endocarditis, etc., reveals the true nature. Torticollis may be the only evidence of the disease, and may be followed by invasion of the heart. Very puzzling are the cases in which only the hip is affected. This may be suspected of being early tuberculosis, and Brill mentions a case that was sent to the hospital for suspected perityphlitis and another for intussusception. Purpura is a fairly frequent accompaniment of rheumatic fever, and should always make one watch for rheumatic complications. Erythema occurs less often. Anemia is quite constant, and often develops so rapidly that it may be considered as a symptom of the disease. The subcutaneous nodule is of great importance, as by its means a diagnosis can be definitely made in doubtful cases. Nearly one-third of the cases show them, most often about the olecranon process and condyles of the humerus and femur. They are from millet- to pea-size or larger, are apt to appear in successive crops, may last for three or four weeks or months, or even a number of years.

Diagnosis. The diagnosis of rheumatism should be made very cautiously in a child of three years or under, as it is

then rare. With the vague, indefinite pains it can be made only by the nodules, the heart involvement if it occurs, or a combination of pain, anemia, muscle rigidity, and perhaps purpura. If several of these symptoms are present, the case should be treated for rheumatism. The frequent association of chorea and tonsillitis should never be forgotten; one or the other may often explain the slight joint pains. A severe pain in the limb or limbs of an infant is much more apt to be due to luetic epiphysitis or to scurvy; in fact, is practically never due to rheumatism. Gonorrheal rheumatism most often invades the small joints, and is usually confined to one, with greater local symptoms. Suppurating joint lesions should not confuse, nor those occurring with the other acute infections.

Prognosis.—This depends on the effect on the heart and serous membrane. The frequency of cardiac affections is remarkable, it being variously estimated at from one-quarter to nearly one-half the cases. And the mild joint symptoms may be succeeded by very severe endocarditis. The joint lesions are rarely serious. A disheartening feature is the extreme likelihood of recurrences, and the manifestly greater danger to the heart in several attacks.

Treatment.—A child with acute or subacute rheumatism should be kept at rest in bed in a room with equable temperature until all the signs have disappeared. If the attack has been at all severe, it is best to insist on staying in bed for a week after the symptoms have subsided. If the joint pain is severe, it may give relief to make very hot applications, preferably dry, and keep the parts wrapped in thick cotton and relieved from the pressure of the bedclothes. The diet should be light, but particularly nourishing.

The effect of the salicylates is so decided as to be almost specific. This is not nearly so well demonstrated in the subacute attacks to which children are so liable. What effect salicylate has in lessening the danger of heart disease is questionable, but it should be used in every case for its possible effect. It should be given in large doses on the first day or two, 10 grains every two hours for five doses to a child of eight years. After this it can be continued three

times a day until the symptoms have completely subsided. It should always be given combined with some alkali, as sodium bicarbonate, in sufficient quantity to render the urine alkaline. Sodium salicylate is as good as any. Water should be given freely. During convalescence it is always advisable to give a course of tonic treatment with some form of iron.

Great care should be exercised to prevent subsequent attacks. The child should never be out in rainy weather, should never be chilled; in fact, should be kept in the house during inclement weather. The clothing should always be sufficiently warm, wool being worn throughout the cool and cold weather. An older child should be impressed with the fact that he must take such care of himself during adult life.

If such a child has bad tonsils, or is subject to attacks of acute tonsillitis, the tonsils had better be removed.

EPIDEMIC MENINGITIS.

Definition.— Acute epidemic meningitis, or cerebrospinal fever, is a specific, contagious disease due to the invasion of the meninges by the diplococcus of Weichselbaum. Numerous other organisms occasionally cause acute meningitis, but the organism described by Weichselbaum has a definite affinity for the meninges, and has been therefore called the meningococcus. The pneumococcus, staphylococcus, streptococcus, the influenza and tubercle bacilli, and rarely others, may be the cause of meningitis. Tuberculous meningitis will be described separately, but the others are so similar clinically to the epidemic form that they need no separate description. Positive differentiation can be made only by finding the organism in the spinal fluid. They are practically always secondary to some evident process elsewhere, such as acute pneumonia, suppurative otitis, influenza of the nasopharynx and bronchi, etc.

Etiology.— Cerebrospinal fever is due to the Diplococcus intracellularis of Weichselbaum. This is a Gram-negative coccus found within the white cells of the spinal fluid, and also in the leukocytes of the circulating blood. It can be demonstrated in the spinal fluid in nearly every case, and

can be grown on Löffler's medium or on ascitic fluid. It can generally be demonstrated in the nasal secretions of infected children.

Most cases occur in children under six years of age, and the great majority in children under ten. Adults are often affected, being the majority in a few epidemics. Epidemics occur most often in the late winter and early spring. Sporadic cases may be seen at any time of the year.

The contagiousness is comparatively slight, though instances of several children in one family being infected are not rare. Healthy children are affected as readily as delicate ones. One attack does not confer immunity.

Pathology.—The lesions are most noticeable in the meninges at the base of the brain, much less on the cortex as a rule. The meninges of the cord may be affected very little, even in cases with marked exudate at the base of the brain, but there is always some spinal involvement. This is mostly along the posterior surface of the cord. In some cases nearly the whole cord may be covered with a thick, purulent exudate.

In cases dying very suddenly there may be only marked injection and edema of the meninges. Cases of longer duration show a purulent exudate. Still later there are fibrinous deposits with marked thickening and adhesions, and perhaps invasion of the ependyma of the ventricles. The ventricles may be dilated from a collection of purulent fluid. The brain tissue shows congestion, small hemorrhages, and often small areas of necrosis and abscess formation. The cortex may be thinned from a marked secondary hydrocephalus. In chronic cases the meninges show thickening. Permanent adhesions to the brain and to the cranial and spinal nerves are common. The changes in the spinal meninges are the same, but usually much less pronounced.

Incubation Period.—This is rather uncertain but is probably short, from three to ten days. Apparently contagion is due to personal contact, or to contamination with the discharges from the mouth, nose or conjunctiva. The disease is probably not carried by a second person, who has been exposed, to a third person except in rare instances.

Symptoms.—The common form begins rather abruptly with headache, photophobia, vomiting and fever, followed very soon by neck rigidity and hyperesthesia. Frequently the illness begins with a chill, or a convulsion, with sudden delirium and acute pain and tenderness in the back of the neck. The temperature rapidly rises to 103° or 104° F., and is likely to be irregular; it is rarely continuously high. Pulse and respiration are rapid, and are also apt to be irregular. The most characteristic of the early symptoms are the severe headache, vomiting, early delirium, hyperesthesia, and muscular rigidity. In mild cases the symptoms may not be pronounced enough to be very noticeable, but they can usually be elicited by careful observation. As the disease progresses the marked symptoms are muscular rigidity, mainly of the neck but affecting all the somatic muscles, the extreme hyperesthesia, the headache, and the delirium. These usually continue without much change for days. During the course of several weeks there are apt to be remissions and exacerbations that may be extremely puzzling.

In the typical case the head is drawn back to such an extent that the child cannot lie on the back. Feeding is often difficult because of this position, and because of the rigidity of the facial muscles.

Loss of weight and strength is rapid, the pulse soon becomes very fast and thready, and severe attacks of vomiting are frequent and uncontrollable. Constipation is the rule throughout. In fatal cases there is a gradually deepening stupor, weak, irregular pulse and respiration, lessening of rigidity, retracted abdomen, marked emaciation, and death from exhaustion. The course of the disease is from one to six weeks.

If recovery takes place, the temperature falls very irregularly, the stupor or delirium lessens, and all the signs slowly subside. Rigidity of the neck is the last symptom to disappear. A number of weeks or months is necessary for complete recovery.

In the ordinary form there is a marked polynuclear leukocytosis. This is sometimes as high as 80,000 to 90,000, and is usually about 40,000. There are certain signs that are

of special value in the diagnosis of meningitis, though none of them is diagnostic. Kernig described the peculiar rigidity of the leg, in which the leg cannot be fully extended when the thigh is flexed at a right angle with the abdomen. Brudzinski noted the sudden involuntary drawing up of the knees when the head is bent suddenly forward. The pupils are at first usually contracted and later dilated and unequal. They react sluggishly to light, and when the disease is well advanced often will not react at all. Babinski's sign is often present, but is not reliable and has no special significance. None of these symptoms is constant or even of any special value without various others.

Cases of all degrees of severity and rapidity, or mildness and chronicity are seen, but the above is the usual form, particularly in sporadic cases. Most puzzling are the fulminant cases, with abrupt onset, very high fever, restlessness, intense headache, rapidly developing coma, and death perhaps in a very few hours. These are the cases in which the petechial eruption is often seen, and because of which the disease has been called "spotted fever." It does not commonly occur in the ordinary or the chronic forms.

Of particular interest is the chronic form, often called chronic posterior basilar meningitis. It is seen much more frequently in infants, following a moderate attack of the ordinary type. The process is most marked at the base of the brain posteriorly. The exudate seals the opening of the aqueduct and results in hydrocephalus. The condition is characterized by low fever, extreme opisthotonus, general muscular rigidity, emaciation, and usually complete consciousness. There is always hydrocephalus present, and in infants the head is enlarged; in older children the enlargement may be slight or absent. In no other condition is such extreme opisthotonus seen. All the reflexes are much exaggerated, Kernig's, Brudzinski's and Babinski's signs are present, and there is the characteristic hyperesthesia. Fever is slight and may be absent a great part of the time. This condition may last for months, death resulting from exhaustion, pneumonia, or other complications. The prognosis is very bad.

Sequelæ. These are very important and quite frequent. The child is occasionally left mentally deficient. Epilepsy of any degree, deafness, blindness, paralysis of any or all the limbs, of the face, or the muscles of the eye, may result.

FIG. 31.—Chronic posterior basal meningitis. Showing extreme opisthotonus and marked rigidity of limbs. Picture was taken with camera placed above the child who is lying on the floor. (St. Louis Children's Hospital.

Diagnosis. The only accurate method of diagnosis is the withdrawal and examination of the spinal fluid. This is easily done by the harmless lumbar puncture. By this means a positive diagnosis can be made on the first day, or at any time thereafter. The best means for this is a small trocar and cannula, such as are sent out with the serum by several drug firms. The larger needles are too apt to draw

blood. The puncture is best performed by having the child lie on the side on a firm surface, with the thighs and head flexed so as to have the spine curved as much as possible. Occasionally a very little chloroform or ether may be used if the child is very rigid or very hyperesthetic. Local anesthesia is of little avail, as it will not anesthetize the periosteum. The midline between the bodies of the third and fourth lumbar vertebræ is the best point, but between the fourth and fifth will do. The proper site may be determined by going in below the spine which is on a level with the highest

FIG. 32.—Child in position for lumbar puncture. The line crosses the fourth lumber vertebra. The space either above or below the spine may be entered. (St. Louis Children's Hospital.)

point of the crest of the ilium. As soon as the canal is entered fluid should flow freely. It may be allowed to flow as long as it will, but if the flow is very free, it should be stopped at intervals to prevent too sudden lowering of the pressure. If, when the canal is entered, the fluid flows out in very rapid drops, it can be considered that the amount is greater than normal.

Immediate examination of the specimen with the microscope will often show the meningococcus, or whatever organism is present. But if it does not, it will certainly

show the presence or absence of meningitis by certain chemical tests.

First, the fluid is practically always turbid, perhaps only opalescent; pus cells predominate very decidedly. This is not the case in tuberculous or syphilitic meningitis, or in poliomyelitis. The positive butyric acid test, the ammonium sulphate, and the colloidal gold tests show definitely the presence of meningitis; but they will not certainly differentiate any form of meningitis.

In differentiating the organisms which may cause purulent meningitis it is well to remember that the meningococcus is the only Gram-negative coccus of those that cause meningitis; this is particularly useful in differentiating from the pneumococcus.

Prognosis. The mortality prior to the use of Flexner's serum was from 50 to 60 per cent.; and the recoveries included many cases with very distressing disability, idiocy, epilepsy, blindness, etc. With proper and early use of the serum the mortality is from 15 to 30 per cent., and the serious complications are comparatively rare. In infants the mortality is much greater, but it has also been decidedly lessened by the use of the serum. Hydrocephalus often causes a fatal outcome in infants after the acute symptoms have quite subsided.

Treatment. The only effective means of treatment is the specific serum originally prepared by Flexner by immunizing horses to the disease. It is bactericidal, and is effective only when injected into the spinal canal and acts directly on the bacteria. The earlier it is used the more effective it is; after thick exudation and adhesions are present not much is to be expected from it.

All the fluid that will readily flow is withdrawn from the canal and approximately the same amount of serum slowly injected, after being warmed to body temperature. If only 4 or 5 c.c. are withdrawn, it is best to inject at least 15, but slowly and with great caution. Small infants will often take only 5 c.c. The gravity method is safer than the use of a syringe, the container being held from 2 to 4 feet higher than the needle.

The serum should be repeated every day until all the acute symptoms have disappeared. The neck rigidity may last long after the other symptoms have subsided, and does not by itself indicate the need for more serum. Often the effect is extraordinary, the fever, delirium and pain lessen, the leukocytosis diminishes, and the spinal fluid rapidly clears. In cases of chronic basilar meningitis no result can be obtained.

When for some reason the injection cannot be made into the canal, or when there is evidence of fluid in the lateral venticles, with no relief from the use of the serum, puncture of the lateral ventricles has been practised and the serum injected. This is particularly useful in infants, and if carefully and skilfully done, is not dangerous; in older children it is, of course, a much more difficult procedure. It is rarely necessary, however.

The serum should be used at once if spinal puncture reveals a turbid, purulent fluid, without waiting to see whether or not the meningococcus is the cause. If it proves not to be, no harm has been done; if it proves to be, valuable time has been gained. If any other organism is found, of course the serum is to be discontinued, as it will do no good.

Other treatment is symptomatic. The bowels should be freely opened. Fever and headache are lessened by the ice-cap and application of ice along the spine. The various sedatives and narcotics are used as indicated, bromide and chloral, trional, antipyrine, and morphin. When stimulation is needed, any of the stimulating drugs may be used except strychnin. During delirium it is best to tie the child in bed if he is left alone, even for a few minutes. Particular attention must be paid to nutrition, forced feeding being often necessary. The skin must be kept clean, and the formation of bed-sores prevented by not allowing the child to lie on one side constantly.

Urination should be kept track of, as retention of urine may occur and need the catheter.

Treatment of the sequelæ is not of much benefit. Prolonged massage, passive motion, electrical stimulation, etc., should be tried for the paralysis. In chronic cases that are

recovering the use of potassium iodide and mercury over long periods of time seems to be sometimes beneficial.

Treatment of the other forms of acute meningitis is entirely symptomatic. Aside from the above measures repeated lumbar punctures are advisable for the relief of symptoms, and because of the bare possibility of recovery in some of them. Great relief is sometimes procured by the puncture.

TUBERCULOUS MENINGITIS.

Of all forms of sporadic meningitis this is by far the most common. It has been called acute hydrocephalus and basilar meningitis, both names being not at all descriptive, as other forms have the same location and effect.

Etiology.- It is due to infection of the meninges by the tubercle bacillus, following infection elsewhere in the body. Three-fourths of all cases occur in infants under two years, and it is comparatively rare after five years. It is much more frequent in cold weather, and in children with evident tuberculosis elsewhere, or with an hereditary taint. But it not rarely occurs in children in apparently perfect health.

Pathology. The inflammation is much more pronounced at the base, being often seen only there. There are the usual tubercles, with more or less fibrinous patches. Adhesions between the brain and the pia mater are constant. There is practically always some distention of the lateral ventricles, for which reason the condition has been called acute hydrocephalus. Miliary tubercles are sometimes present in the choroid coat of the eyes. The amount of tubercles and exudate may be surprisingly small. Probably a tuberculous process is present elsewhere in the body in every case. In the order named, there is most frequently general or pulmonary tuberculosis, marked involvement of the bronchial glands, or advanced bone tuberculosis.

Symptoms. In the great majority of cases there is a prodromal period of a week or more in which the child is decidedly irritable, complains of headache, has spells of vomiting, is constipated, and the appetite is poor. Following this are undoubted symptoms of cerebral disease. First

there is unusual drowsiness, but with complaints of headaches and photophobia; attacks of very severe crying are common. The pupils are normal or contracted, and do not respond readily to light. The temperature is slightly raised at some time in the day, rarely over 101° F. The child is very fretful if disturbed. There is evident hyperesthesia, some rigidity of the neck and extremities, and increased reflexes; attempts to bend the head forward cause pain. Pulse and respiration are both apt to be irregular, and present important evidence. Constipation is very marked, and the attacks of vomiting continue.

These irritative symptoms are succeeded by the paralytic. The stupor becomes pronounced. Pupils are irregular and sluggish, strabismus is common, twitching and purposeless movements of the muscles occur, and opisthotonus is marked. There is often paralysis of one or more limbs, and this may disappear in a few hours, to recŭr again later. By this time the fontanelle, in infants, is tense and bulging. Gradually the stupor becomes profound, the child cannot be roused, rigidity lessens and reflexes are lost, the fever rises, pulse and respiration become slow and irregular, the pupils rigid and widely dilated. Death follows in deep coma or in general convulsions.

The skin reaction known as "tâche cérébrale" is rather constant; it consists of a raised, red line produced by drawing a pointed object along the skin, such as a lead-pencil or the finger-nail. The breathing is often typically irregular as the irritative symptoms subside. There is a gradual increase in depth up to a deep, sighing inspiration, and then a short period of apnea; the superficial breathing begins again, with the same climax and pause.

The duration of the disease is from three to four weeks. Often with infants it is much shorter.

Diagnosis. — This is made definitely only by lumbar puncture, though by the time paralytic symptoms have developed the diagnosis is usually quite evident. The fluid is usually under considerable pressure. It is crystal clear until comparatively late in the disease.

It gives the various reactions distinctive of meningitis.

The cells are increased in number, but the great majority are mononuclears. The colloidal gold test gives a rather typical reaction. In probably every case careful examination will reveal the tubercle bacillus.

The most valuable diagnostic symptoms are irritability, headache, vomiting and constipation, slight neck pain and rigidity, and low fever.

Prognosis.—This is invariably bad.

Treatment.—There is no treatment other than making the child comfortable. Usually there is little complaint or apparent discomfort after the first few days, as the child sleeps a great deal. Repeated punctures have the same bearing here as in the other forms as mentioned above.

ACUTE ANTERIOR POLIOMYELITIS.

(Infantile Paralysis.)

Definition.—This is an acute, specific infection resulting in such injury to the tissues of the spinal cord, and less often the brain, as to cause paralysis of various groups of muscles. It has a remarkable selective affinity for the cells of the anterior horn of the cord, but may affect other nuclei and tracts. Conditions that were formerly called acute bulbar palsy, and acute encephalitis inferior are simply the extension to these structures of the virus of poliomyelitis.

Etiology.—It is very much more common in children than in adults. Most of the cases are sporadic, but it does occur in rather localized epidemics; widespread epidemics with thousands of cases have not occurred in this country until the New York epidemic of 1916. The danger of such an epidemic should always be considered as possible. The disease is not apparently very contagious, as not often is more than one child in a family affected. It is commonest in the hot weather, and the epidemics seem always to occur then. Children from six months to three years are most susceptible. The observation that it occurs largely in suburban or rural districts is difficult to explain, and is largely responsible for the belief (probably erroneous) that flies are carriers of the disease.

The organism causing the disease has been isolated and found to be an exceedingly minute, filterable coccus, just visible as tiny, refractile granules with the highest possible magnification. It is anaërobic, and otherwise very difficult to cultivate, this feat having but recently been performed by Flexner and Noguchi at the Rockefeller Institute. It is always present in the diseased tissues during the active stage of illness, being most numerous in the spinal cord. It is nearly constantly found in the nasopharynx in the acute stage of the disease, and often for weeks afterward; this suggests a probable mode of entrance to the meninges.

Very little is positively known as to the means of transmission of the disease. It is certain that the discharges from the nose and mouth are infectious, probably in every case. And it seems quite likely that cases carry the contagion after recovering from the disease; also that some may be so little ill as not to be confined to bed, and so carry the contagion; or that persons exposed to the disease may carry the virus without being at all affected by the disease. All of which is known to be the case in diphtheria.

Pathology.—A remarkable special affinity is shown for the spinal meninges and the meningeal vessels. There is an extensive infiltration with leukocytes, especially about the walls of the vessels. The vessel walls are often packed with cells, the lumen narrowed, or even obliterated. This results in lessened blood supply, particularly to the anterior horn, and there results edema, degeneration or necrosis. Often there are tiny hemorrhages. Although the nerve tissue affected is chiefly the gray matter of the anterior horns, there is frequently the same change in the posterior horn cells, the white matter about the canal, the nuclei in the medulla and pons, the basal ganglia or the cortex. There is always marked inflammation of the pia mater. The most extensive changes are usually at the cervical and lumbar enlargements, either or both, on both sides, or only one. Not rarely the entire cord is affected, with the medulla, cerebrum, and parts of the cerebellum. Such extensive involvement gives rise to symptoms strongly resembling meningitis and result in death from bulbar paralysis.

In recovery there may be complete return of the parts to normal.

More often there is death of some anterior horn cells with degeneration of the nerve filaments which is permanent. With extensive destruction of the cells there is more or less newly formed connective tissue, and the affected portion of the cord is reduced in size.

The other striking feature is the atrophy of the muscles supplied by the affected nerves. This is constant in moderate and severe cases, and may be extreme. The limb is smaller, shorter, and the bones are smaller. These results are due to actual death of the muscle tissue, which may be very extensive. Many very characteristic deformities are caused by the paralysis, and by the unnatural positions in which the limbs are allowed to remain when paralyzed.

Lesions in other parts of the body are not characteristic.

Incubation.—The incubation period is indefinite and hard to determine. It is probably about ten days. Inoculated monkeys develop symptoms in from four to thirty days.

Symptoms.—The onset is usually sudden, with fever, vomiting, and prostration. Often there soon is pain in the neck, back and legs, less often in the arms. Not infrequently there is such rigidity of the neck, and muscles elsewhere, with marked hyperesthesia, that meningitis is suspected; these cases are likely to have high fever and delirium, or general convulsions. But very often, particularly in the sporadic cases, there are no symptoms to lead one to suspect any involvement of the central nervous system. The acute symptoms last only three or four days and subside rapidly. Many of the cases develop in a way that is not characteristic, resembling any sort of mild acute febrile disease, and the diagnosis is not made until the paralysis develops. In some cases no paralysis occurs, but in these the diagnosis cannot be made definitely unless the spinal fluid is examined, or occur under such circumstances (exposure in an epidemic) as to make the diagnosis likely. In some cases the paralysis occurs without the child having been ill enough to be in bed.

The distinctive symptom is the paralysis. About the fourth or fifth day of the disease careful observation will show

some weakness of the muscles of the affected parts. In another day this has become a definite paralysis. It is of the flaccid type. The reflexes are lost but sensation is perfect. The most common form is paralysis of one leg and foot,

FIG. 33.—Typical and common muscular atrophy, due to poliomyelitis.

next both legs, next both legs and both arms. One arm and one leg, or both arms alone may be affected; and rarely one arm alone. The trunk muscles, muscles of respiration or deglutition, the muscles of the heart, or the bladder or rectum

may be paralyzed. When swallowing, respiration, and heart action are interfered with, the case is spoken of as acute bulbar paralysis; death then usually results in a few days.

Except in fatal cases the initial involvement is much greater than the final paralysis. There is always some degree of recovery in the affected muscles, and in a few cases recovery is complete. The improvement begins after about two weeks and may continue for two or three months. Any paralysis remaining after this time is probably permanent, and by this time the atrophy is strongly marked. Certain groups of muscles are particularly likely to be affected, as the deltoid of the shoulder, the peroneal of the leg, and the extensor of the thigh.

Atrophy is noticeable in three or four weeks, and if the paralysis is extensive, the size of the limb is much diminished as atrophy increases.

Diagnosis.—Before the onset of the paralysis this is usually impossible. During epidemics the diagnosis in a given case is much more apt to be suspected, and a lumbar puncture will then make the case certain. In the acute stage, in the sporadic cases, the diagnosis is usually not made unless the spinal fluid is examined; the paralysis comes as a surprise. If poliomyelitis is suspected, lumbar puncture should be performed. The fluid is usually slightly turbid or opalescent, but may be clear. It contains a great preponderance of mononuclear cells, and shows the various reactions that occur in meningeal inflammations, *i. e.*, Noguchi's butyric acid, ammonium sulphate, and colloidal gold tests. After the acute stage the fluid rapidly returns to normal. This fluid differs from that in acute meningitis in the slighter turbidity, the excess of mononuclears, and the rapid return to normal. The leukocyte count in the blood is not nearly so high as in meningitis. These two items will always serve to differentiate from epidemic meningitis; in the acute stage the symptoms themselves may not enable one to decide.

Peripheral neuritis is the only other disease likely to be confounded. This is rare in children except after diphtheria. There is then little doubt as to the diagnosis. In other cases there is usually considerable sensory change, bilateral, sym-

metrical palsy is the rule, and the distal portions of the limbs are most affected.

Certain obstetrical palsies may be impossible to differentiate from old poliomyelitis except by the history.

Prognosis.—Except in the bulbar cases this is good as to life. But the number recovering without paralysis is comparatively small. In the epidemics the mortality ranges from 5 to 25 per cent., rarely higher.

The severity of the paralysis may be judged from the degree and rapidity of the wasting. The return of reaction to faradism is the best sign of improvement in the muscles.

Treatment.—As little is definitely known of the methods of transmission of the disease, nothing but certain measures of precaution can be taken to prevent it. Suspected and positive cases should always be isolated. Those who have been definitely exposed should cleanse the nose and throat before mingling with others. Children who have been exposed should be isolated until they are proved not to be infected. Unfortunately no means is available, as is the case in diphtheria, to positively determine the presence or absence of the infecting organism.

There is no specific treatment. The disease is to be treated in general as any other acute infection, with restricted diet, laxatives, and proper sedatives as indicated. Cold applications to the head, neck, and spine may be used, more for comfort than for any probable limiting of the inflammation. Absolute rest, if necessary by full doses of the sedative drugs, is the prime indication. The effect of any measure or any drug on the course of the disease is distinctly disappointing.

In animals the early use of large doses of hexamethylenamine has shown undoubted results, but early diagnosis in children is so difficult that it is rarely possible to begin it early enough. It should certainly be used. Twenty-five grains a day to a three-year-old child is the proper amount. given in frequent doses with considerable water.

The measure that offers the greatest hope is the use of the serum of those recently recovered from the disease. This is now being given trials that will determine its value.

When paralysis has developed, the limbs must be supported

in a normal position to prevent the contractures and deformities that so quickly develop. When all acute symptoms have subsided, a systematic course of electrical stimulation and massage of the affected muscles must be instituted. This necessitates first a careful examination to discover as nearly as possible exactly what muscles are affected. Then the stimulation, massage, and proper exercises should be made a matter of routine for many months. Recently it has been shown that decided improvement may follow the application of these measures in cases of two or more years' standing. The treatment is most beneficial in the first year, and it should be faithfully practised for that time.

Orthopedic measures, operation, braces, etc., are necessary for many cases of permanent paralysis.

TUBERCULOSIS.

Definition.— Tuberculosis is due to a specific organism, the tubercle bacillus first described by Koch. Certain manifestations of the disease (bones, meninges, etc.) have been described elsewhere under separate headings, but none of them is likely to communicate the disease to others. In this chapter are described its manifestations as a general infection, and its manifestations in the lungs. Pulmonary tuberculosis is the chief cause of the spread of the disease.

Etiology.— Tuberculosis in various forms is extremely frequent in children. Until recently it was thought that pulmonary tuberculosis was rare in infants and young children, but it is now known to be very common. It occurs at all ages and increases in frequency with age. Statistics to show the frequency of tuberculosis in general do not mean very much, except to show the great prevalence of it, for many children dying of other diseases are found to have latent tuberculosis at autopsy, and a great many react to the tuberculin test who have no symptoms of the disease, and never develop any. In this country the statistics are taken mainly from hospitals and large institutions, and they show that tuberculosis is present in nearly 15 per cent. of children dying of all diseases. According to the von Pirquet cutaneous tuberculin test

as applied to clinic and hospital patients, and to school children, from 40 to 70 per cent. are infected with tuberculosis. A very large proportion of apparently perfectly healthy children give the reaction, particularly those over two years of age.

In general it may be said that anything which affects the general health and thus lessens the resistance, predisposes to the infection. The tendency to develop it may be hereditary because of parents suffering from tuberculosis, or any chronic, enfeebling disease. Attacks of measles, whooping-cough, influenza, grave nutritional disturbances, etc., predispose to the disease. Crowded quarters, insufficient air and food, filth, and imperfect protection from the weather, all lessen resistance and favor the development of tuberculosis.

The disease is so prevalent that almost everyone is exposed to it to a certain degree, and if the resistance is sufficiently lowered, infection is likely to follow. But perfectly healthy children are often infected, and then it is generally through exposure to someone suffering from pulmonary tuberculosis. Less often it is from contaminated milk, utensils, infected rooms, etc., but all these means are comparatively rare.

The bacillus itself is very resistant, living for long periods of time in dust, dirt of all kinds, and is in this way widely disseminated. The discussion as to the comparative importance of the human type and the bovine type in children has no place here, but it seems certain that infection with the bovine type, generally from milk, is comparatively rare, particularly in tuberculosis of the lungs.

Infection may take place through the lungs, the mucous membrane or abraded skin. But in all probability the vast majority of infections are through the medium of the respiratory tract. This may be through the lungs primarily or through the lymph glands by way of the tonsils, throat or bronchi. Invasion through the mucous membrane of the intestines is undoubted, but much less frequent than the former. Any inflammatory condition of the nose, throat and bronchi, adenoids, tonsillitis, bronchitis, etc., make the infection much more likely to take place.

Pathology.—Any organ or tissue of the body may be affected. The pathology has been elsewhere described as it effects the

meninges, peritoneum, bones, and glands. The process is essentially the same in all. First the formation of the tiny, pearl-like miliary tubercle, the necrosis and caseation, with infiltration about it, the confluence of two or many, with the ultimate destruction of tissue of almost any amount. By far the commonest sites are the lungs, pleuræ, and the bronchial lymph glands; the liver, spleen, intestines and mesenteric glands, the kidneys, or the brain and meninges, are affected, one or more of them, in a large proportion of cases; the cervical glands and the bones are not so frequently affected in general tuberculosis. The organ which shows the greatest variation in the form and the severity of the infection is the lung. Here there may be a slowly progressing bronchopneumonia, usually starting at the hilum; a more rapid pneumonia resembling the ordinary bronchopneumonia; a very rapid process with large, rapid consolidation; and a general miliary involvement almost confined to the lung. The lung is always affected in general miliary tuberculosis. The chronic ulcerative phthisis which is so common in adults is usually seen only in older children.

The pleura may show any degree of inflammation, from a a serous effusion without much thickening to a dense fibrinous pleuritis which binds nearly the whole lung to the costal pleura, or forms a fibrinous, cheesy exudate which is called a tuberculous empyema.

The bronchial glands are affected in the same way as the cervical. Their importance lies in the frequency with which the lung, or indeed the blood stream is invaded through them. But they also cause marked effects from pressure, being often so large as to interfere seriously or even fatally, with respiration. Sometimes they are so large as to obstruct the trachea and bronchi, make considerable indentations in the lungs, and they may interfere with the proper recognition of the parts postmortem.

A great deal of controversy is going on as to which is usually the primary infection, that in the lungs or that in the bronchial glands. Most observers report many cases in which the glands are shown to be affected postmortem without ascertainable lesions in the lungs. This seems the

rational condition and well explains the frequent invasion of the roots of the lungs. But some careful, competent observers claim to find involvement of the lung in every case of gland infection. The process in the lungs is evidently the primary one, and it is confidently asserted that the lesion in the lung will be found to be primary in every case. This has been demonstrated by Ghon and others in so many cases that we may be forced to change our opinion as to the bronchial glands being usually the primary focus.

The infection is more frequently latent in these glands than in any other portion of the body. It frequently exists without any tuberculous manifestation, often heals without causing any trouble, and may, when active, invade the lungs by ulceration or extension through the capsule, or ulcerate into the bronchi, trachea or esophagus; or, by means of the circulation, may infect the meninges, abdominal organs, or produce a general systemic infection.

Tuberculous involvement of organs other than the lungs and bronchial glands has been considered elsewhere, or at least those that have any special significance in children. Particular involvement of the kidneys, bladder, etc., is not common, being usually a part of a general infection, and the detailed description will be found in works dealing with the infection as it occurs in adults.

Tuberculous Bronchopneumonia.—Tuberculous bronchopneumonia is much the most frequent form of the disease in children, and will be given detailed description.

Etiology.—The infection may be primary in the lungs or secondary to tuberculosis in other parts of the body; when secondary, it most frequently develops from infected bronchial glands. In whatever way it develops it is very apt to follow other acute diseases; and it is apt to follow frequent attacks of simple bronchitis, or develop during bronchopneumonia.

Pathology.—Both lungs are usually involved, there being a more or less diffuse bronchitis with areas of consolidation, perhaps necrosis and cavity formation, and practically always considerable involvement of the pleura. The greatest involvement is often in the upper lobes posteriorly, but it is generally fairly diffuse through the lungs.

Symptoms.—The onset is much more insidious than in ordinary bronchopneumonia, and usually certain suspicious signs can be made out before the child is manifestly ill. Very often the first symptom to attract attention is the cough. This resists all efforts to control it, and soon it is evident that the child has slight fever nearly all the time. Observation now shows that the breathing is accelerated, pulse rapid, and there are signs of lung involvement. The fever continues, but is not usually as high as in simple pneumonia. The cough soon becomes deep, prolonged and distressing; loss of appetite, weakness, anemia and wasting develop, and the progress of the disease is gradually toward a fatal ending within a few weeks; often the condition drags on for months, but with the same result.

The signs are those of an ordinary bronchopneumonia. There is no way to distinguish between them except by the onset, general course, and the fatal outcome. Very often the signs are more those of a bronchitis than a pneumonia, as the process is very diffuse and no frank consolidation is evident. But the great severity of the illness, with its failure to subside, arouses suspicion as to its nature. Nearly always there are in some areas the fine, subcrepitant rales that show the probable pneumonia. When the course is comparatively rapid and short, there may never be any signs other than the numerous moist rales throughout the lungs, death taking place before there is much consolidation.

Still more puzzling are the cases with evidence of pneumonia which seems to be clearing up and the child improving. But instead of becoming perfectly well he continues to have slight fever and the signs of consolidation remain. This is the condition of chronic fibroid phthisis, which may remain for months, lighting up again as a fresh pneumonia. This may be repeated again and again, until the child ultimately dies of a diffuse pulmonary process, meningitis, or general tuberculosis.

A similar state of affairs is apt to apply to the disease when it follows pertussis or measles, or simple bronchopneumonia. The child improves after the primary disease and seems to be progressing very well, though there may be still

a little fever every day, and a slight cough. He may seem to be perfectly well. After two or three weeks or longer the fever rises, the cough increases, the signs in the lungs become apparent and the disease then progresses in one of the above ways.

In infants a particularly suspicious feature is the persistence of rales in the region of the hilum behind. These may be present for weeks or months, and the child have no symptoms other than a slight cough, occasional attacks of slight fever, or simply not be very well in general—appetite poor, stationary or lessening weight, bad stools, etc. The rales may disappear at times, but recur frequently and finally become constant. And at any time the pneumonia may develop.

Chronic Tuberculous Pneumonia.—This has been mentioned as one termination of the acute form. It nearly always occurs as a sequel to it. It is not very common, and may be very puzzling. All degrees of involvement are seen in most cases, as bronchitis, consolidation, necrosis and cavity formation. The signs are those of an ordinary pneumonia, but they may be present with little fever or distress, until an exacerbation occurs. The child is thin, weak, has considerable cough, rather rapid breathing, and is manifestly in poor condition. The termination may be from spreading of the process, or from some other tissue invasion, meningitis, etc.

The chronic ulcerative phthisis which is so common in adults is rarely seen in young children. As it occurs in older ones, which is usually after the sixth year, it presents the same features as in adults.

Tuberculous Bronchitis.—This has also been mentioned above as frequently occurring in infants with very few signs of illness. It often occurs in older children. The typical early feature is the presence of rales in one locality of the lungs, often in the interscapular region, but perhaps anywhere in the lungs. The rales, with a persistent but not distressing cough, are often the only evidences of lung disease for weeks or months at a time. But in most of these cases the bacillus can be found in the sputum by careful searching. In infants the sputum is invariably swallowed, but enough may be obtained for examination by inserting a cotton-covered probe into the larynx and provoking a paroxysm of coughing;

with the aid of a tongue depressor the expelled sputum can be withdrawn before the child can swallow it. This procedure is of very great importance in the diagnosis of this condition, as it cannot positively be made in any other way. It is successful in a large majority of cases, and removes a dangerous source of contagion by showing that such a child must be isolated or watched carefully to prevent others from contracting the disease.

General Miliary Tuberculosis.—In this disease the bacillus gains access to the blood stream from a primary focus elsewhere, with a resulting infection of the entire lungs and the abdominal viscera and peritoneum; the brain and meninges are often also affected. It presents quite different features, according to the violence of the infection, and also differs as it occurs in infants and older children.

Symptoms. In older children the onset is so indefinite and puzzling that the disease is rarely suspected, and it may be a week or more before the child is thought to be seriously ill. He is irritable, sleeps and eats poorly, is weak and tired, and loses in weight. After from one to three weeks fever is manifest, and then the evidence of serious illness is noticeable. The child stays in bed, and soon there is a state strongly resembling typhoid fever. The fever, drowsiness, restlessness, and frequent delirium, anemia, weakness and wasting, and very often a palpable spleen, are present. Nearly always bronchitis is evident early in the disease.

These symptoms are subject to occasional remissions and the temperature is apt to be irregular. There is nothing about it by which it can be recognized as tuberculosis until, as usually occurs, there are signs of consolidation in the lungs. These appear as a bronchopneumonia, and the case terminates with diffuse lung involvement. Much less often meningitis or peritonitis may be the prominent feature. In any event the degree of wasting is extreme before death, and this is often so marked in a very few weeks as to make the diagnosis of tuberculosis probable.

In infants the symptoms of general infection are so indefinite that little can be said about them. The diagnosis can usually only be suspected because of tuberculous taint,

PLATE III

A Comparison of Intracutaneous Reactions
(von Pirquet's Method.)

1. Inoculation with undiluted tuberculin old.
2. Dilution of old tuberculin 1:4.
3. Dilution of old tuberculin 1:16.
4. Dilution of old tuberculin 1:64.
5. Control.

or in the absence of any other reason, malnutrition, etc., for the illness. It is characterized by progressive loss of weight, anemia and pallor, irregular fever, restlessness, and the general signs of poor nutrition. The infant may die without developing any other symptoms, and the true nature of the disease only be discovered at autopsy. Usually in the course of a few weeks there are apparent the signs of involvement of the lungs and a diffuse bronchitis or bronchopneumonia; or not infrequently meningitis develops. It may thus be seen that the condition is an exceedingly difficult one to interpret, even more difficult than the same condition in older children. In any event it is always fatal, though the length of the illness may be two or three months.

Diagnosis of Tuberculosis.—In adults this depends largely on the discovery of the bacillus in the sputum. In children this cannot be at all depended upon except in the cases of bronchitis with ulceration; here it is quite valuable. The history of the family, of the illnesses the child has previously had, possible exposure to someone known to have pulmonary tuberculosis, and a very careful history of the onset of the present disease, are of more value than the physical examination. Rather characteristic is the insidious onset, often with remissions, the cough, and the anemia and loss of weight, usually out of proportion to the evidence of disease. The leukocyte count is not increased in uncomplicated tuberculosis, and this may be of assistance in differentiating from pneumonia.

Of great value is the use of the tuberculin test. This is most often applied now by means of the von Pirquet technic. The skin of the forearm is cleansed and dried. Three small points of excoriation are made an inch or more apart with the small chisel or with a flat, sharp tooth-pick. The upper and lower are at once inoculated with a very small drop of undiluted tuberculin and allowed to dry. Within eighteen to forty-eight hours small papules develop at these two points, surrounded by a pink or red areola; the size of the latter indicates the degree of the reaction. Although of great value, the test (or any other tuberculin test) should not have too much stress laid upon it. If the test is properly performed, with good tuberculin, and is negative, it is very

good presumptive evidence that tuberculosis is not present in that child. But a positive test is given so often by children who are, and remain, perfectly well that it does not necessarily give a bad prognosis, particularly in a child over two years of age. And it is certain that sometimes a child ill of some febrile disease shows a positive test, and it is decided that the febrile disease is tuberculosis; but the positive test may be due to some small focus, lymph gland, etc., which has nothing to do with the other illness, and the child shows it by again becoming perfectly well. So certain restrictions must be placed on the use of the test. In general it is of much more value for definite information in infants than older children.

The *x*-ray often gives valuable confirmatory evidence.

Tuberculous Bronchial Glands.—This is so intimately associated with pulmonary tuberculosis that it is best described in the same connection. The etiology, pathology, etc., have been sufficiently discussed. It is of peculiar importance in children and particularly in infants, because of its extreme frequency and the fact that it sometimes gives definite signs, which may be so typical that the diagnosis may be made with considerable precision.

There are three rather definite groups of glands, one about the trachea, the second about the bifurcation and the large bronchi, and the third following the secondary bronchi into the substance of the lung. Considerable enlargement of the first may encroach on the great vessels or the pneumogastric and laryngeal nerves; the second is much more apt to affect the œsophagus and trachea or bronchi; the third rarely gives symptoms that can be referred to it. Very important is the fact that the bacilli may live for years in these glands without causing softening, but are likely to become active during some acute illness, general weakness from any cause, or perhaps by a process of very slow caseation and ulceration. Through them the lungs may be invaded, or the pleura, pericardium, œsophagus, or the general system.

Symptoms.—It is not often that definite symptoms can be referred to the enlargements of these glands. The most common one is the cough. Occasionally this cough is extremely suggestive of enlarged glands; it is frequent,

insistent, of harsh, metallic sound, and occurs in severe paroxysms much like pertussis. If the cough is very distressing (or rarely without the cough), there is apt to be some dyspnea. If this dyspnea is expiratory, and particularly if there is some stridor with expiration, it is probably due to enlarged glands pressing on the trachea or bronchus. Recurring attacks of dyspnea is a very suspicious circumstance if there are no lung signs to account for them; it may be difficult to differentiate from croup. Recurring dyspnea and cough may be due to pressure of the glands on the superior vena cava, but there is then no retraction of the chest and no stridor; it may cause slight cyanosis of the face, puffiness and perhaps edema. An abscess sometimes forms (described elsewhere as retro-esophageal abscess) with subsequent rupture into the esophagus, trachea or vessel, or it may burrow extensively in the mediastinum. The diagnosis of such an abscess is usually impossible antemortem.

The signs by which these glands may be demonstrated are rarely present unless they are considerably enlarged; and unless very suspicious symptoms are present the signs are decidedly unreliable. Percussion may give dulness at the side of the upper dorsal vertebræ behind, or along the upper margin of the sterum. Very feeble breathing over one lobe, or an entire lung, is a very suspicious circumstance, and in a child otherwise well it is nearly diagnostic. The very clear, whistling respiration over the lower cervical area posteriorly is a valuable sign; breathing may be of the pure amphoric variety. D'Espine's sign, the audible whispered voice sound in the region of the upper thoracic vertebræ, is of value in suggesting the presence of enlarged glands. The *x*-ray shadow is sometimes of great value as a confirmatory item.

It must be remembered that all the physical signs, and many of the symptoms, may be due to other tumefactions in this area: Hodgkin's disease, malignant tumor, etc.

Tuberculides.—It is becoming more and more evident that the disease is rather commonly manifested in infants by the appearance of the small, acneform tuberculide on the skin. It is very often not recognized; in fact, it is very often overlooked. The lesion usually causes no discomfort, is very small and apt to be widely disseminated, and there are

usually only a very few present at one time. They most commonly appear on the buttocks, abdomen and thighs, but may be present anywhere. It is a small, red papule with little or no areola, usually with a small vesicle at the top; this quickly dries and leaves a small crust, and if this is scraped off it leaves a small pit in the centre of the papule. This then heals and forms a tiny white scar. The tuberculide is usually a sign of well-advanced tuberculosis and is a bad prognostic sign.

General Prognosis.—Demonstrable tuberculosis anywhere in the body, except of the bones and glands, offers a bad prognosis in childhood. With slight pulmonary involvement the disease has been, in some instances, held in abeyance for months or years, and some cases certainly cured; but this is a comparatively rare occurrence except in older children with incipient chronic ulcerative phthisis. The older the child the better the chance, but advantage must be taken of the very first symptoms.

It is certain that the mortality in infancy is not as high as many statistics show.

Treatment.—The prevention of the disease is a matter of such infinite detail that it can be hardly touched on here. Its most important item in childhood is the prevention of exposure of any child to a person affected with pulmonary tuberculosis. If this one thing were carefully lived up to, infantile tuberculosis would diminish amazingly. Older children are, of course, subject to infection in the same way as adults, and to them the general detailed efforts apply. The danger from milk from tuberculous cows is perhaps overestimated, but it should be the business of the municipality to prevent the sale of milk from such cows; the source of supply of the milk for infants should be known, and none but milk from tuberculin-tested cows should be used.

Weak, delicate children and those with a bad heredity, should be particularly watched, prevented from catching cold, and placed in such surroundings as to make infection unlikely; or they should be carefully clothed, fed, and kept much in the air when advisable, if there is any suspicion of the presence of the disease. Bad tonsils and obstructive adenoids should be removed from such children.

Little can be said as to the treatment of the disease. And the necessary features are by this time fairly well known to all who can read. Fresh air and sunshine can hardly be overdone; the more a child is exposed to them the better, even if he is unable to be up and about. The diet is of paramount importance, for these children must be very well

FIG. 34.—Tuberculides. Many small scars are shown where lesions have healed. (St. Louis Children's Hospital.)

nourished. Simple food is necessary, and the child's tastes must be consulted very much more than is the case with adults; the eggs and milk diet will not often appeal sufficiently to a young child to be the main reliance of the diet. In general it is best to give what wholesome food the child best takes, having it consist as largely of milk, cream, butter and eggs as can be.

Drugs have very little place, and are best dispensed with if the child eats well and gains at all in weight. Citrate of iron and quinine in sherry often assists a poor appetite. In some cases creosote has a good effect on the cough and the digestion. Cod-liver oil is of great benefit in many cases, particularly when the child will not eat sufficient food. If it upsets the stomach, or the child rebels strongly, it is unwise to insist on it.

Much has been claimed for the tuberculin treatment, and it is certainly to be hoped that it may yet prove efficacious in some mode of application, but as yet the results in the hands of most of us have been distinctly disappointing. It is wise to use it, by hypodermic injection, in suitable cases in order to obtain its value, if any, and to endeavor to come to some definite conclusion as to what its merits are.

SYPHILIS.

Definition.—This disease is due to the organism discovered by Schaudinn, and called by him the Spirocheta pallida. In children the disease is manifested as an hereditary infection which differs materially from the acquired form; the latter is so rare that it will not be considered, except to remark that it is in all respects comparable to the acquired disease of adults, and the possibility of it should always be kept in mind when lesions of the acquired type are encountered.

Etiology.—The disease is contracted *in utero* from a mother with syphilis. If the mother has secondary syphilis, the child rarely escapes, though in this stage stillbirths or miscarriages are apt to be the result. A later pregnancy is much more apt to result in a viable baby than is the first one, no matter what the stage of the disease in the mother. The more remote the acute stage is in the mother the less likely is the child to show evidences of the disease, and the symptoms are more apt to be mild or of obscure nature. A woman who becomes infected with syphilis in the last few weeks of pregnancy is unlikely to communicate the disease to her child.

Danger of Contagion.—For some unknown reason the contagiousness of congenital syphilis seems to be very slight.

Until recently the immunity of the mother to infection from the child was given as evidence of the lack of contagion of congenital syphilis, but it is now known that this is because the mother has the disease. But the experience of all observers is that the danger of infection from a child with hereditary lues is slight, even to healthy wet-nurses who suckle such infants.

Pathology.—Any tissue of the body may be affected by the disease. And yet there are cases of proved hereditary syphilis, in which syphilis is undoubtedly the cause of death, in which no demonstrable pathological change is made out at autopsy.

Aside from the numerous manifestations on the skin, the common lesions are the gumma, the endarteritis, and the productive, interstitial inflammation. These processes may produce an infinite variety of pathological states in the various tissue. But perhaps an even greater variety of abnormal conditions is produced by the disease without ascertainable pathology and without the discovery of the spirochetæ anywhere in the body. The lesions differ very noticeably in the form in which the disease is manifested in infants (early hereditary lues) and that in older children (late hereditary lues).

The liver is the organ most commonly affected in infants. It is enlarged, often considerably, and presents a diffuse hepatitis with marked interstitial proliferation and atrophy of the liver cells. After the first year there are frequently gummata in the substance of the liver, together with the hepatitis. In the late syphilis liver changes are much less common but of the same nature. The spleen is decidedly enlarged in nearly every case, but it is usually a simple hyperplasia with some sclerosis, and does not often show the typical lesions of lues. The bones very frequently show typical changes which have been described under that heading. These are often seen in the nasal bones and, with the catarrhal rhinitis, have been described under that heading. Any other organs may be affected but the changes are not distinctive except in the nervous system and the eye. The latter is principally of importance from the frequent develop-

ment of an interstitial keratitis, much more often in the late form.

In the brain, and less often the spinal cord, the gumma, the endarteritis and a gummatous meningitis are all frequently seen, and less often atrophic encephalitis. Hydrocephalus is not uncommon. Atrophy, degeneration or agenesis of

FIG. 35.—Congenital syphilis. Showing the ulceration about mouth and nose; and marked scaling of the skin. (St. Louis Children's Hospital.)

portions of the brain or cord may exist in almost any degree in syphilitic children, due either to the definite lesions or to the disabling effect of the virus acting in some imperceptible manner.

Symptoms.—To describe the symptoms that may be due to syphilis would take a volume in itself. With the advent

of the Wassermann reaction it has been made manifest how much more frequent the disease is in children than we had suspected. This applies particularly to the tremendous variety of nervous manifestations due to late hereditary syphilis. No attempt will be made to detail them here. In fact, the diagnosis of this form is very often impossible unless

FIG. 36.—Congenital syphilis. Same case as above. This shows the typical rhagades, the linear scars about mouth and nostrils after the lesions have healed.

suspicion is aroused by the family history, etc., or a blood test is made as a routine measure or as a last resort. The many congenital defects, hare-lip, spina bifida, heart lesion, etc., are presumed to be due in some cases to this disease. That some of them are present in cases of syphilis is certain, but that they can be in the least relied upon as evidences of the disease is far from being proved. Much good work is

being done, and more should be done, to further our knowledge along this line. Many idiots, mental and moral defectives, etc., are undoubtedly so because of inherited syphilis, and many of them at one time no doubt had evident physical signs of the disease which were disregarded or misinterpreted. These facts should stimulate us to be on the lookout for the disease in young children. But it is possible here only to mention the comparatively frank signs of syphilis as it appears in infants and young children.

These appear in the great majority of cases within six weeks. Except in severe, wide-spread infection the infant is usually apparently healthy at birth. If it is evident at birth the infant is wasted, wrinkled, very weak and anemic, and lives only a short time. The skin shows various lesions, but nearly always the so-called pemphigus, numerous large bullæ on the palms and soles, and scattered over the body. Rhinitis, large spleen and liver, and the bone changes are generally present, and often the small scars or fissures of the lips and nostrils.

Those in good condition oftenest show the snuffles as the first symptom, usually with some hoarseness. Before long the eruption appears, generally first on the face, hands, and feet. It is commonly a macular, pea-size eruption, having the distinctive luetic color. It lasts from two to six or more weeks and is followed by scaling of the skin, often evident on the hands and feet for many weeks. Fissures and mucous patches are very common and typical; they are most frequent about the lips and nostrils and the anus, and are apt to leave fine, linear scars at the junction of skin and membrane that are very important in diagnosis. With the eruption there is very frequently tenderness of the limbs and perhaps demonstrable enlargement at the epiphyses, due to the epiphysitis. The tenderness may be exquisite, and the pain so severe as to cause apparent paralysis. Bleeding from the nose or mouth, loss of hair, ragged finger- and toe-nails, large spleen and liver, are all very frequent signs. Only one or two of the above symptoms may be present, but any one of them should arouse suspicion, and some are diagnostic alone.

Anemia and wasting are soon apparent and are steadily progressive until the most extreme degree is reached, often resulting in marasmus. But very often the symptoms and signs spontaneously disappear and the child progresses in a fairly satisfactory way, to show other developments of syphilis many months, or perhaps years later.

Many varieties of cutaneous lesions may be present during this period, and nearly always there is more than one kind, as is so common in lues. The chancre does not occur in hereditary lues. Papules, pustules, and a scaling erythema often are seen, or only a decided scaling without eruption, often confined to the palms and soles. The enlargement of the lymph nodes is not of special value in the early hereditary syphilis.

Late hereditary syphilis is usually considered as a development occurring at about the eighth year or later. But quite similar lesions often appear as early as the third or fourth year, and no age is exempt from them after the first few years; it is now considered settled that they may develop in early adult life, due to an hereditary infection. Probably most of them have had the signs of the disease in infancy which were disregarded by the parents or so slight as to be unrecognized by the physician.

It is in this form that a tremendous variety of symptoms occurs, improper development, physical and mental; a wide range of nervous conditions, paralysis, idiocy, insanity, meningitis, and resemblance to a number of other nervous diseases. A whole chapter could be written on cerebrospinal syphilis alone, and therefore it is unwise in a work of this scope to endeavor even to outline the symptoms. Only the more typical or suggestive signs will be described.

One of the most important and typical lesions is the interstitial keratitis, manifested as a diffuse haziness beginning near the centre of the cornea. With it there is some dimness of vision and irritability of the eye. One eye is usually first affected, the other after some weeks. Photophobia frequently develops and is an unfavorable sign.

Changes in the bones are very frequent, and have been elsewhere described. The bosses on the skull, the sabre

tibia, irregularities along the shins, etc., are frequently the only means of diagnosis. Arthropathies are not uncommon, and may be exceedingly difficult to interpret; the knee is most often affected, showing a synovitis much like the tuberculous form; this is apt to be symmetrical, while tuberculosis

Fig. 37.—Congenital lues. Typical scaling, especially of the soles. (St. Louis Children's Hospital.)

is not. The nasal deformity known as "saddle-back" is not rare, due to destruction of the bone and cartilage.

The teeth are often affected, and sometimes so typically as to be diagnostic. The changes occur in the second set. They are irregular, eroded, rounded or peg-shaped, often very small and irregularly indented at several places on the

sides. The typical ones described by Hutchinson are the incisors, especially the upper central ones; they have the above characteristics, but also have a marked, crescentic notch along the whole biting surface; they are always small, and may be quite useless for biting. Although so typical, it is unwise to make a diagnosis without good confirmatory evidence.

Deep ulceration of the nose or mouth, especially with perforation of the palate, is very suggestive. Deafness, either from otorrhea or nerve involvement is common. Enlargement of the liver and spleen is quite constant. The enlarged lymph glands are of more importance than in infancy, but not nearly so commonly seen as in adults.

FIG. 38.—Hutchinson's teeth in a girl, aged ten years. Many other evidences of syphilis. Wassermann 4+.

Of the skin lesions there is a considerable variety, much the same as in acquired lues. Macules, papules, pustules, and gummata occur with considerable frequency; but the subcutaneous gumma is the most frequent and characteristic. It begins as a deep, firm, circumscribed tumor with some induration around it and usually some redness or surrounded by a red border. In the course of a week or two it tends to soften, break down, and discharges through the skin, leaving a rounded ulcer of considerable depth with firm, thickened edges. It soon becomes covered with a hard, thick crust and may so remain, with intermittent discharging, for weeks or

months. When healed, it leaves a smooth white scar that is rather typical. They are most common on the upper third of the legs and thighs.

Diagnosis.—The diagnosis of infantile syphilis, when there are any manifest symptoms at all, is usually easy, for there are nearly always confirmatory signs made out by careful examination. Infants having the eruption, or the snuffles, or bone tenderness, palmar scaling, etc., will usually be found to have large liver and spleen, anemia, poor general nutrition and rhagades about mouth, nostrils, and anus. Often in the cases of idiocy, physical defect, simple malnutrition, etc., the diagnosis can be made only by the laboratory tests.

In late syphilis many of the lesions make the diagnosis with little question; the saddle-nose, typical teeth, keratitis, sabre tibia, perforated palate, and others. Very important also is deafness. But of great interest and importance are the cases that show none of these, but are simply undernourished and stunted, with an appearance of general ill-health. Many of them show no evidence of any trouble whatsoever. Here, also, the Wassermann is the greatest aid.

A careful history, where syphilis is considered a possibility, is often convincing. Other children with possible syphilis, an infection admitted by the mother or father, one or more miscarriages without ascertainable cause, all offer clues as to the diagnosis. In fact, cases will be missed entirely unless such a careful history is taken in every case of obscure illness.

Laboratory aids are numerous and important. Discovery of the spirochetæ in the lesions is conclusive, but comparatively difficult. The Wassermann reaction is of decidedly the greatest value. So specific is it that if it is properly done by one with large experience it can be accepted as making the diagnosis. In fact, it is so definite that it is in danger of being abused, and too little attention is paid to the clinical evidences of lues in the effort to make a diagnosis unaided by the blood test. And the prevalence of the disease is so great that it not infrequently happens that a child ill with some other condition is thought to suffer only from syphilis because of a positive blood test; and the syphilis actually is not responsible for the present symptoms at all. It is best used

with the most careful clinical examination, and used as confirmatory evidence. This test applied to the spinal fluid is of great value in the diagnosis of cerebrospinal lues, as in many cases the blood is negative. Of secondary importance, but of considerable value, in the cerebrospinal forms are the spinal fluid cell count, globulin reactions, and the Lange gold chloride test. None of these is by itself diagnostic, but if two or more are positive, and the symptoms very obscure the possibility of lues is strong.

Prognosis.—The toll of death from hereditary syphilis is very large, and we are indebted to the Wassermann reaction for explaining many of the deaths that were heretofore misunderstood. Death ascribed to syphilis in adults is a comparative rarity; in infants and young children it is very common. A child born with evidences of the disease usually dies promptly. If it lives, it is apt to show marked mental and physical stunting, and die before many years of some acute illness. Strong, well-formed babies who develop the symptoms many weeks after birth offer a fairly good prognosis if vigorous treatment is instituted early and persisted in. But they have lessened power of resistance to other diseases, and the death-rate in general is much higher than in untainted children. The prognosis depends on the time of appearance and the severity of the symptoms; the later they appear the better the outlook.

Treatment.—This should manifestly begin with the father and the mother. As soon as a woman known to be syphilitic becomes pregnant she should be given intensive treatment, and carefully watched during the term of gestation. This is particularly necessary if she becomes infected during pregnancy. Syphilitics who are not cured certainly should not marry.

Treatment of the infant or child needs little description. The only drugs to be considered are mercury and salvarsan, potassium iodide being of comparatively slight benefit except in a few cases. Now that the first stampede to salvarsan is over, it is beginning to be evident that in most cases mercury is just as effective, and in many cases the effect is as rapid. And the ultimate cure is no more certain with one than with

the other. Either must be used over long periods of time, the effect being tested by frequent examinations of the blood.

Mercury is best given by inunction, 10 grains of unguentum hydrargyri being rubbed in thoroughly every day in the case of a newborn infant; the dose may be 15 to 20 grains from six months to a year. For rapid effect it is sometimes advisable to give some soluble salt by hypodermic injection once a day. A very good formula is 0.5 per cent. each of bichloride and sodium chloride in water; one drop is injected in the buttock, and the dose is increased one drop each day until it is evidently sufficient, or until cramps, diarrhea, etc., show the limit of tolerance. Usually from $\frac{1}{20}$ to $\frac{1}{10}$ grain can be used. By mouth gray powder or calomel, grain $\frac{1}{4}$ to $\frac{1}{2}$ three times a day, is often very effective. Symptoms of mild mercury poisoning must be watched for, and they call for a cessation of the drug for a week or so. Ordinarily it is wise to interrupt the treatment for a week or two every two months. It must be kept up for three years, at least, and the blood tested every year thereafter indefinitely.

Salvarsan is best given always in the vein. For infants the dose is 0.02 to 0.06, and the dose increases with the age up to 0.1 or 0.2 at six years, according to the size of the child. It may be given dissolved in a very small amount of water (precipitated and redissolved by means of sodium hydrate); 0.02 may be given in 10 c.c. A vein of the elbow, scalp, neck, or even the longitudinal sinus can be used for the injection. It is well to give three doses at intervals of a week; others to be given at longer intervals as indicated. The best results are obtained when mercury is used in combination with it, either from the very beginning, or after the first three injections have been given.

Neosalvarsan is given in a dose one-third larger. It has the advantage of being easier to make up, requires less water, and is said to be less toxic, with the same therapeutic value.

Potassium iodide is given for the same indications as in adults and is of practical value only in the late form. Keratitis, gummata, bone lesions, and various forms of cerebral lues are the usual indications. It should be begun in small

doses and the amount rapidly increased; 20 to 30 grains a day may generally be taken without discomfort, and is sufficient. Continued small doses are of no value.

Cutaneous lesions, or those on the mucous membrane, are treated as are other ulcers. In the mouth a bichloride wash may be advisable if there is considerable ulceration. Externally the best application is powdered calomel and bismuth, half and half.

Tonic treatment of some sort is indicated sooner or later in nearly every case. This is apt to be lost sight of in the desire for continued specific treatment.

CHAPTER XIX.

DISEASES OF OBSCURE ORIGIN.

THE DUCTLESS GLANDS.

In recent years a great deal of attention has been given to the part played by the various so-called ductless glands in the causation of certain well-defined and many ill-defined syndromes. Some of them are of comparative rarity in children and will be very briefly considered; others are more commonly seen in children, and they will be given more consideration.

Some of the small glands, the thyroid, adrenals, and pituitary particularly, are known to have active principles of very definite action. This can be demonstrated by extracting the substances from the glands of animals and subjecting them to definite pharmacological tests. If any of these glands is overactive, and secreting into the blood an excessive amount of its active principle there results a train of symptoms of fairly uniform character, and in frank cases the particular gland at fault can be determined by the symptoms. On the other hand, if the gland is inefficient, and producing too little of its product, there results another train of symptoms, more or less opposed to the symptoms of overactivity, and of sufficient uniformity to enable us many times to determine the cause of the trouble. In the latter cases artificially supplying the extract of the particular gland will often cause the symptoms to lessen or disappear; in the former the difficulty is greater, but rarely the symptoms can be made to subside by lessening the activity of the gland by excising a part of it. If the cases were all of the variety due to marked hypersecretion, or to complete lack of secretion, the diagnosis would usually be easy. But it is evident that there may be all degrees of over- or undersecretion, with the result that there

are all degrees of the two classes of symptoms, due to slight, moderate, or marked over- or undersecretion. This makes the diagnosis often exceedingly difficult, and often quite impossible; we can often only suspect that a certain gland may be at fault and use the indicated gland therapy on suspicion.

A marked feature of abnormality of these glands is the effect on the nervous and circulatory systems, and the great influence on growth and development, both physical and mental.

A further complication of the subject is due to an apparent interdependence of the glands upon one another. Cases are encountered in which the deficiency of one gland seems to have a depressing effect on the secretion of another, and if the proper secretion is supplied artificially, it not only alleviates the symptoms due to the deficiency of one gland, but excites normal secretion in the other.

It is therefore evident that the whole question is a very complicated one. Only certain cardinal facts are known; a great deal of the rest is largely theory or conjecture. But enough is known to stimulate further investigation, as the field is a large one. Some very distressing conditions that were heretofore considered hopeless can now be definitely aided by means of ductless gland therapy.

DYSPITUITARISM.

The pituitary gland is the one that causes the most confusing variety of pathological states. The gland lies in the sella turcica of the sphenoid, and is attached to the base of the brain by the infundibulum. It consists of an anterior and a posterior lobe, each of which has a different function, and of course different symptoms result from hyper- or hyposecretion of either. And, more than this, if one lobe is overactive and the other underactive the result is generally such a very complicated syndrome that it is exceedingly difficult or quite impossible to analyze it. In many cases there are first symptoms of overaction of the gland, followed after some years by symptoms denoting the gradual failure of the secretion.

Physiology.—In dogs, removal of the pituitary is followed by death in a few days with lowered temperature, profound weakness, lethargy, and coma. Total removal of the anterior lobe causes a similar result. Total removal of the posterior lobe has no well-defined results. Partial removal of the anterior lobe causes infantilism, as shown in undergrowth, lack of sexual development, lack of bodily hair, etc. Adiposity is common, especially when the posterior lobe is removed also. Partial removal of the posterior lobe causes low blood-pressure, subnormal temperature, dry skin, scant hair, a tendency to adiposity, and increased sugar tolerance. Extirpation of a portion of both lobes causes a mixture of the two syndromes; polyuria (diabetes insipidus) is a fairly common result.

Hypersecretion is not so definitely a matter of experimental observation, but it may be said in general that overaction of the anterior lobe is manifested by gigantism, increased vigor, abundant hairy growth, early and marked sexual development, and high blood-pressure. The relative importance of the two lobes is not known, but probably the more important is the anterior.

Symptoms.—It is not possible to go far into the symptoms, for aside from the conditions above outlined there are other symptoms due to pressure of the tumor that is perhaps causing the abnormality of the pituitary; headaches, optic atrophy, and many other evidences of intracranial pressure. Only the more important signs will be considered.

In hyperpituitarism the marked symptom is gigantism. These children grow rapidly, are very strong, vigorous, and early show the signs of maturity—well-developed genitals, abundant hair, etc. The skin is rough and the follicles large, the skin secretion abundant. In the adult the result is the well-known acromegaly, the chief features of which are due to the fact that the epiphyses have ossified and the gigantism of early life is therefore impossible. After years of such growth and overdevelopment the secretion of the gland begins to fail and the evidences of undersecretion begin; these are not seen in children, however, except in very rare instances.

Hyposecretion is shown by marked adiposity, in which

males show a decidedly feminine distribution of the fat; small bones, smooth skin with very fine, scanty hair, infantile genitalia, normal mentality, sluggish temperament and often

FIG. 39.—Hyperpituitarism in boy of thirteen years. Strong and vigorous; weighs 230 pounds. (Duke.)

marked psychoses later in life. This type is presumed to be due to deficient posterior lobe.

If there is deficiency of both lobes, there is also dwarfism, optic atrophy, and evidences of atrophy of the sexual glands. Polyuria and increased sugar tolerance are frequent.

Temperamental changes are of some importance in indicating the onset of dyspituitarism. Oversecretion is apt to show mental activity with lack of concentration, wakefulness,

Fig. 40.—Hypopituitarism in boy of twelve years. Very small and fat, thin skin, silky hair, no hair on body; genital hypoplasia; mentally bright. (Duke.)

Fig. 41.—Hypopituitarism (thin case) of six years. Probable partial deficiency of both lobes. Small stature (compared in Fig. 42 with normal child of same age), hypoplastic genitals, thin skin, silky hair; bright mentally. (Duke.)

irritability, etc. Hyposecretion shows marked docility, good temper, affection, with ultimate failing of the intelligence and mild psychoses; epilepsy is not infrequent.

Often all these symptoms are combined with those of intracranial pressure due to cyst, new growth, etc. Occasionally there is enlargement or deformity of the sella turcica, which may be demonstrated with the *x*-rays. Rarely the sella may be seen to be unusually small.

Fig. 42.—Case of hypopituitarism compared with normal child of same age.

Prognosis and Treatment.—Little can be said of either. As yet we have no very clear idea of the general prognosis in any but the marked cases. In them the outlook is generally poor. Hypersecretion is quite baffling. Hyposecretion can

be relieved to a certain extent but not enough to produce a normal individual. Operative procedure is attended with considerable danger, and is for the relief of pressure symptoms only.

In the cases of undersecretion the prepared extract is given by hypodermic injection in ascending doses. An initial dose of five drops every two or three days can be given to a six-year-old child. The greatest variations in size and interval of dose will be found at times advisable.

DYSTHYROIDISM.

Abnormalities of the thyroid gland give rise to two definite, striking conditions in children, one due to overaction and the other to marked or complete deficiency. The former is so rare in young children that it will be only briefly mentioned; the latter is usually evident very soon after birth. When the hyposecretion occurs in adult life it presents a very definite picture also.

Thyroid hypersecretion is variously called exophthalmic goitre, and Graves's or Basedow's disease.

Symptoms.—It is characterized by comparatively slight enlargement of the gland, prominent eyeballs, rapid heart, tremor, and considerable nervousness, perhaps amounting to mania.

Moderate hyperthyroidism is shown by restlessness, insomnia, rapid growth with emaciation, abundant hair, cardiac and nervous irritability, and perhaps slightly protruding eyes.

Cretinism.—Lack of secretion, called cretinism, is a very definite entity. It is nearly always due to congenital lack of the gland or perhaps a gross pathological defect. There is no known hereditary tendency. Rarely it follows some acute disease. It is not a common condition, being much less frequent than Mongolism.

Symptoms.—Hyposecretion is usually apparent by the sixth month, sometimes not being very definite before the second year, rarely later. In infants the first signs are the coarse, straight hair, boggy cheeks and eyelids, thick lips, protruding tongue, low forehead and broad nose, making the eyes seem far apart. The skin is thick, dry and doughy, the abdomen large,

the fingers short and thick, and the size less than that of a normal child.

With age many other characteristics appear. The child is backward in everything and is soon seen to be idiotic. The teeth appear very late, the fontanelle is open perhaps six or

Fig. 43.—Cretin. Seventeen years of age. Treated with thyroid extract for many years.

more years, walking is long delayed, they talk little or not at all, are obstinately constipated and nearly always have an umbilical hernia. Prognathism is usually marked. In three or four years the dwarfing is manifest. The arms and legs are short, the head seems too large for the body, the neck short

and thick, abdomen very large, skin dry and often eczematous, the temperature subnormal, movements slow and clumsy, and the disposition sluggish and placid. The sexual organs are only slightly developed.

FIGS. 44 and 45.—A case of sporadic cretinism. Fig. 44, before treatment, aged twenty-three months, height 28 inches, circumference of the abdomen 19 inches. Fig. 45, after treatment with thyroid extract for five and a half months, height 30 inches, circumference of abdomen 15 inches. (Osler.)

Lesser degrees of hypothyroidism present all manner of modifications of the above. In fact, various writers have recently been so inclusive that it is hard to think of any chronic, obscure condition that has not been said to improve under thyroid therapy. But certain forms of eczema, deficient growth, slight mental backwardness, sensitiveness to

cold, imperfect genital development, etc., may quite possibly be due to deficient thyroid. This possibility should always be considered and the therapy instituted if there seems any occasion for it; it can do no harm if used judiciously.

Diagnosis.—In the frank cases it is important that this be made early. In little babies the early signs are coarse, straight hair, rough, dry skin, large, protruding tongue, and prominent abdomen due to constipation. These are associated with more or less evidence of slow mental development and delay in holding up the head, sitting alone, etc. When the case is well developed, the condition is manifest at a glance to anyone who has once seen a typical case. A skiagram of the hands shows delayed appearance of the centres of ossification, and their delayed progress to complete ossification; this is best seen in the hands, but is evident in any of the long bones.

Prognosis.—The course of hyperthyroidism is largely dependant on the possibility of surgical aid. Some cases that become manifest about the age of puberty tend to improve or recover spontaneously, but such children are apt to remain permanently nervous and unstrung, although the actual signs of hyperthyroidism disappear.

Cretinism is always improved by the use of thyroid extract if given early enough. But a return to normal has probably never been seen; even with constant use of the extract these children are far from normal throughout life. Most of them die of other diseases before reaching adult life.

Treatment.—In hyperthyroidism no medical treatment of any sort is of lasting benefit. The use of the serum or milk of animals from whom the thyroid has been removed has proved of little avail, though it sounds rational. Rest, overfeeding, sedatives, and other palliative measures are all subordinate to the surgical removal of a large part of the gland.

Hypothyroidism is affected remarkably by the use of the thyroid gland of the sheep, preferably the fresh gland; this is so hard to obtain that the powdered gland or the extract is generally used.

In the cretin, if begun early, the change in the child is truly remarkable. In some cases the uncouth, animal-like face in a few months becomes that of a normal child, the growth is

stimulated, the intelligence increases amazingly, and it is hard to believe that the treated child developed from the little monstrosity. But improvement is manifest up to a certain point and then becomes less and less evident, and finally a point is reached where it is evident that the child will never be as other children. In many cases the improvement is not so noticeable, and if it is delayed several years there may be no great improvement in any way.

Lesser degrees of hypothyroidism are usually treated on the supposition that they are due to thyroid deficiency, and the diagnosis depends largely on the effect of the treatment. Many of them improve decidedly; in some the condition (eczema, backwardness, etc.) may entirely clear up, when it has resisted all other treatment.

The gland is given by mouth in the form of powder or tablet, and reliable preparations are marketed by various firms. To a baby of six months one-half grain is given once a day; then twice a day when it is well borne; and increased in size and frequency as indicated. It should be increased until toxic signs appear, and then cut to the largest dose that causes no trouble; this may be as much as two grains two or three times a day. Signs of overdose are marked irritability, rapid pulse, flushing of the skin with profuse perspiration, often a slight fever; rarely the symptoms may be alarming, but they subside rapidly if the gland is discontinued. Needless to say the medication must be continued throughout life, although the time comes when the only effects noticed are the retrogression of the patient if the therapy is discontinued.

ACHONDROPLASIA.

Achondroplasia, or chondrodystrophy, is a rare condition characterized by lack of growth of the epiphyses or diaphyses, or both, of the long bones, resulting in dwarfism because of the stunted growth of the limbs.

Etiology. The condition is congenital, but the causes are unknown. Most babies so affected are born dead or survive only a short time. Heredity is apparently not a factor of importance.

Symptoms.—The striking feature is the shortness of the arms and legs, the trunk being normal. The body is often quite plump and then the legs and arms are ludicrously short and fat, with deep folds in the skin. The hands often have a

FIG. 46.—Achondroplasia. Note shortness of limbs. This child's mental development is very little below normal. (St. Louis Children's Hospital.)

peculiar shape, due to the spreading of the ends of the fingers —the so-called "trident hand;" the fingers are very short and of nearly equal length. The forehead is usually very prominent and there is a deep depression at the base of the nose; this gives the upper jaw an appearance of great prominence.

Later on these children show the same characteristics, but with modifications. They learn to walk late, and with walking they develop a marked lordosis with prominence of the hips. The shoulders are thrown well back and the arms hang at an angle that makes them appear even shorter than they are. These dwarfs are slow in learning to talk, read, etc., but are intelligent enough to take care of themselves and usually quite able to earn their living as adults. The muscles develop slowly but they often become very powerful and many of them make their living as athletes in public performances.

FIG. 47.—Showing the "trident hand" of achondroplasia. (St. Louis Children's Hospital.)

Diagnosis.—In infancy this condition may be confused with rickets or hydrocephalus. Measurement from the umbilicus will always differentiate, for in other conditions this is the midpoint of the body and in achondroplasia the distance from the navel to the top of the head is two or three inches greater than to the sole of the foot. Other points of difference are very manifest on careful examination.

Prognosis.—There is no danger to life in the condition, and these children often reach old age and have good health throughout their lifetime.

There is no treatment whatever.

DIABETES MELLITUS.

For a number of years it has been known that this disease in many cases was closely associated with disease of the pancreas. It is true that many cases occur in which no pancreatic change is demonstrable postmortem, but at least it is known definitely that disease of the pancreas very frequently causes glucosuria, which may be permanent. This state of permanent glycosuria is termed diabetes mellitus.

Etiology.—The disease is a very infrequent one in children, and is much more rare in young children. Although diabetes may be caused by injury to the brain, or may occur without ascertainable cause or pathology, it is becoming more evident that the changes in the pancreatic function are the most important ones. These may be due to cancer, abscess, or degeneration due to other causes, or there may presumably be functional disorder without evident pathology, but that most cases of diabetes are due to improper pancreatic function seems indicated. Heredity, the use of great quantities of carbohydrates, trauma, and the acute infectious diseases may be exciting causes.

The disease is essentially a disturbance of sugar and fat metabolism in which the ingested carbohydrates are excreted as dextrose in the urine, and in many cases the fat lessens the sugar tolerance to a certain extent and is badly borne.

Neither the details of the changes in metabolism nor the pathology will be gone into here.

Symptoms.—The most important symptoms are polyuria, thirst and loss of weight; with these there is sometimes enormous appetite, but this is not common in young children. Other symptoms are the excoriation of the vulva in girls, furunculosis, irritability, poor sleep, dry skin and mouth, and urinary incontinence.

Usually the child is brought to the physician because of the frequent urination with incontinence; rarely the mother will note that the urine makes the clothes sticky. The urine then is seen to be nearly colorless, with high specific gravity, and gives readily the various tests for dextrose. All the symptoms quickly become more pronounced, emaciation and anemia be-

come extreme, and the evidences of acidosis are seen. This results sooner or later in coma, in which the child usually dies, unless some complication develops.

Diagnosis.—This depends entirely on the examination of the urine and discovering dextrose. If this is found to be a permanent condition, the diagnosis is made. So it may be said that the diagnosis depends on routine urine examination. If this is not done, cases of early diabetes will certainly be missed, as the diagnosis can be made in no other way. For the significance of acetone, the allied acids, etc., in the urine and blood one is referred to works dealing more extensively with the subject.

Prognosis.—In general this is bad, being worse in children than in adults. Relief or cure depend on early treatment, and even then the majority of cases can often be aided only temporarily. Sometimes a permanent cure seems effected by persistent careful dieting, etc.

Treatment.—None will be considered here but that described recently by Allen at the Rockefeller Institute. And it can be only very briefly outlined; for the details reference is made to various recent articles by Allen. It is yet too soon to determine whether any case of childhood diabetes can be permanently cured, but the results of this entirely rational plan of treatment are superior to those of any other plan.

The first essential is starvation of the patient until the sugar and other pathological elements disappear from the urine. Plenty of water is given, and alcohol sufficient to maintain the strength, if necessary. Blood examinations are made to determine the sugar content, this being done systematically throughout the treatment. When the urine is free from sugar, careful feeding of a varied diet is begun, using first a diet consisting principally of the low-sugar vegetables. This is slowly increased as the urine still remains normal. This increase, always within the sugar tolerance of the individual, goes on until the diet is such that the child gains in weight and is perfectly comfortable. Presence of sugar necessitates a further period of starvation, with subsequent greater caution in feeding. The diet should be carefully outlined and rigidly adhered to by the parents in the home; in this lies the only

hope of permanent cure. The sugar tolerance in some cases is greatly increased by well-regulated exercise; this is an important item in some very obstinate cases.

Treatment of diabetic acidosis is similar to that described under Acidosis.

ADDISON'S DISEASE.

This rare disease is particularly rare in children, and will be given a very brief description. It is a definite condition, characterized by weakness, anemia, low blood-pressure and bronzing of the skin.

Etiology.—The disease is probably always due to disorder of the adrenal glands, both of them being affected. Primary atrophy, atrophy due to inflammation, and tuberculosis of the glands are the known causes, of which tuberculosis is much the most common. Very few cases have been reported as occurring in children.

Symptoms. For some time there is a gradual failing of the general health. The child is weak and languid, tires easily, and is disinclined to exertion. The appetite is poor and the child loses weight. Usually before long there are attacks of abdominal distress, perhaps with vomiting and diarrhea; and by this time also attacks of dizziness and vertigo. The child is evidently ill, but no test of any sort will disclose any signs of disease. But in the course of weeks or months there occurs the pigmentation of the skin which is so characteristic. It is most pronounced on the face, neck, arms, about the genitals, axillæ and navel; the whole skin is affected and usually the mucous membrane of the mouth, eyes, etc. Sometimes the skin presents a patched appearance.

The disease progresses by the increase of all the above symptoms, and it soon becomes evident that the blood-pressure is low. Some cases present this symptom early, some very much later, but it is a constant accompaniment of the disease. There is moderate anemia, but not nearly so marked as the appearance would indicate. Nervous symptoms are of great variety in different cases, stupidity, apathy, headaches, dizziness, and many others. The weakness becomes so marked that the slightest exertion is difficult. Ab-

dominal pain with diarrhea is a very important symptom, but not by any means constant. The temperature is normal or subnormal.

Diagnosis.—This can hardly be made without the pigmentation of the skin. When this occurs, the diagnosis is made by it, if the signs of progressive weakness, etc., are manifest.

Prognosis.—Recovery is not to be expected. Death takes place in three or four years, less often in ten years or even longer. Very few recoveries have been reported.

Treatment.—The treatment of the disease is limited to the use of the extract of the adrenal glands, and to surgery in certain rare instances. Adrenal extract may be used by mouth or subcutaneously. It should be given in small doses, gradually increased as the need is seen. No definite rules for its use can be given.

Symptomatic treatment consists in complete rest, keeping the body warm, giving the most nourishing and easily digestible food, and often some acid to aid digestion. For the attacks of sudden weakness all sorts of stimulation should be tried. Other symptoms must be met with suitable remedies, but care should be taken not to upset the stomach, which is very likely to happen in this disease.

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